THURSDAY, DECEMBER 8, 1892.

THE NEW UNIVERSITY QUESTION.

THE correspondence between Prof. Huxley and Prof. Pearson which has appeared in the *Times* is not pleasant reading. With infinite pains and trouble an Association had been formed to support the foundation in London of a university of a certain type. A nucleus of the most eminent teachers or ex-teachers in London had collected around them a powerful body of supporters from the provinces. In Prof. Huxley as President, and Sir Henry Roscoe as Vice-President, the Association secured the services of two men distinguished both as professors and for their knowledge of affairs. It appears to have been less fortunate in its secretary. Prof. Karl Pearson had some difference with his fellow committeemen on a question of procedure. He himself has described the divergence as not fundamental and has publicly stated that he believes that the other members of the committee were aiming at securing the establishment of a university of the type which he himself approves. So comparatively trifling was the issue, that, according to Prof. Huxley, Prof. Pearson himself proposed that the reason to be given for his resignation should be "pressure of work." No doubt can therefore exist as to the cogency of this motive. His position was apparently even more clearly defined by his not voting against the course of action proposed on the occasion of a meeting which was shortly to take place between the Senate of the University of London and the Committee of the Association, and by his spontaneously pledging himself "to say nothing as a member of the deputation, contrary to what was then agreed to."

It is therefore no wonder that Prof. Huxley was surprised, when on the very next day Prof. Pearson wrote to the *Times*, discussing resolutions which Prof. Huxley regarded as confidential and accusing his colleagues of various offences, of which the day before he thought so little that he had voluntarily stated that "pressure of work" was the reason to be given for his resignation.

One good result may perhaps follow from Prof. Pearson's action. Owing to the sense which has unfortunately been attached to the word "absorb," and to the assumption that the title "Professorial University" meant a University governed solely by Professors, an opinion has got about that the members of the Association are impracticable persons, who have propounded an unworkable scheme. It is true that both accusations are directly met by the published programme of the Association. It is there made clear that a voluntary absorption is all that is aimed at, and that laymen as well as experts are to have a share in the management of the University. Prof. Pearson's defection has made it still more obvious that the Association scheme is intended, not to gratify theorists, but to support a policy which is capable of realization.

Prof. Pearson declares that he desires a University on the model of Berlin; but the question at once arises, Is the model to be followed exactly, or are modifications to be introduced? Is the University to be free from all State control? Prof. Huxley desires that it shall be free, and under existing circumstances we cordially agree with him. Let the State, if it will, nay as it must, support and subsidize the new University as it supports the British Museum, but let the control of the one, as of the other, be in the hands of an independent Governing Body. But, if this condition is realized, there is at once a fundamental difference between the actual University of Berlin and the possible University of London. The external element furnished in Germany by State control must in England be supplied by lay members of the Governing Body, and the difference thus established will run throughout the whole of the constitution.

Prof. Huxley publishes in his letter to the *Times* an outline of a scheme for the organization of the University which is too interesting to be omitted here. He explains that he gives the rough notes on which his evidence before the Gresham University Commission was based.

The scheme is as follows:—

"Do not venture to ask for all I want, but for as much as it seems possible to get on the way to that.

"Suggestions tentative and open to modification.

"(*a*) Retain title and prestige of University of London; reorganize it in such a manner as to secure general uniformity and efficiency of work with freedom and elasticity. In short, unify without fettering.

"(*b*) Make the institutions which contain technical schools of theology, law, medicine, engineering, and so on into colleges of the University. Let these examine their own candidates for degrees, under conditions determined jointly by them and the Senate of the University; and present such as they declare fit to the University for *ad eundem* graduation.

"(*c*) Deal in the same way with institutions giving adequate instruction in the other categories of University work—if they so please; or let the University examine.

"(*d*) Provide ample means for instruction in the modes of advancing natural knowledge and art, either in material connexion with the existing University or in particular colleges.

"(*e*) Professoriate to have large but not preponderant representation in Senate, and wide, but not exclusive, influence in regulating instruction and examination in accordance with the general aim at unification.

"(*f*) All state and municipal contributions, private endowments and University fees for instruction and examination to be paid into a University chest. All professorial staff and current expenses (save in cases that may be reserved) to be paid out of the University chest; also building and fitting expenses where there is no sufficient endowment of a college. The payment of the professorial staff to be primarily regulated by the kind and amount of the work done for the University, not by number of students.

"(*g*) No bar to be placed in the way of any one who desires to profit by any description of University instruction. If, after trial, he does not profit, time enough to exclude. Value of exclusion as disciplinary measure."

Any one who takes the trouble to compare this scheme with the original programme of the Association will see that they are in close accord. It is true that the Association put forward the complete voluntary absorption of the colleges as the result most to be desired, but it distinctly contemplated the possibility of relations between the University and institutions or colleges which were not completely absorbed, and it will be seen that the only terms on which Prof. Huxley will permit relations to be established between the University and the colleges secure to the former a very large measure of authority.

Prof. Huxley himself describes his scheme as of a tentative character, but whatever plan be finally adopted it is desirable that the real aims and objects of the Association shall be fully understood.

It is desired that there shall be one University in London which shall be a central authority to organize and improve higher education.

No reasonable person has ever supposed that the existing University of London was to be destroyed as a sort of peace-offering to its critics, or that existing colleges were to be ignored or dragooned into self-effacement. What is desired is that the Senate of the existing University should be reconstituted by the addition of professors teaching under the control of the University and by a reduction in the number of its lay members, if, with the new additions, it would otherwise be of unwieldy size.

It is desired that a share in the benefits to be obtained from the University should be given to any college only in so far as it is willing to put into the hands of the University the appointment and control of those of its chairs which might be recognized by the University. It is hoped that the advantages which would accrue from this partial fusion would be so great as to lead to the gradual voluntary "absorption" of the colleges. To make this desirable end attainable it is necessary that the College Councils should not be represented, as such, on the Governing Body of the University, but no objection would, we believe, be felt to temporary arrangements which might facilitate the inauguration of the new state of things.

The sooner it is clearly understood that the Association is the result of the labours and the exponent of the views of the "practical men" who are, according to Prof. Huxley, to be found in the professorial ranks, the better it will be for the Association and for London. Prof. Pearson's withdrawal from the secretaryship appears, under all the circumstances, to afford a sufficient guarantee of this.

IN SAVAGE ISLES AND SETTLED LANDS.

In Savage Isles and Settled Lands: Malaysia, Australasia, and Polynesia, 1888–1891. By B. F. S. Baden-Powell, Lieut. Scots Guards, F.R.G.S. (London: Richard Bentley and Son, 1892.)

THIS book contains the impressions of Lieut. Baden-Powell during a journey round the world of over three years' duration; jottings limited chiefly to his own personal doings and observations. The journey was evidently a leisurely peregrination with many divergences to places of interest off his direct route out to Brisbane in Queensland, whither he was bound to assume official duty on the staff of the governor of that colony, and an equally unhurried saunter home again through the Pacific and America. The author does not propose to look at things with scientific eyes, and it is possible here and there throughout the book to detect that he has no profound acquaintance with the *ologies*. Consequently his book does not fall to be rigidly criticized in these pages. His eyes, however, if not scientific, were kept at all events very wide open, and what came under his own observation is clearly and accurately described in a chatty and pleasant style and with a good deal of quiet humour. It is easy to see that the "tramp" enjoyed his trip, and the reader, drawn on by his cicerone's mood, accompanies him through savage isles and settled lands with equal satisfaction. Lieut. Baden-Powell started off through the European continent *viâ* Cologne and Vienna to Rustchuk, thence across Bulgaria, through which "a railway journey is not very interesting." Nevertheless, "little picturesque villages are seen nestling in the valleys, and distant glimpses of the Balkans gained." Beyond Shumla we get through the mountains and "pass through miles of swamp, the railway almost level with the water, and reeds growing up all around, in some places so high as to cut out all view from the carriage windows. Passing along the edges of large lakes, the train starts up thousands of wild fowl, which fly around till the air is quite darkened by them, and on we go, mile after mile, with more and more duck rising from the water," evidently a sportsman's paradise. Thence our guide conducts us to Constantinople and on to Egypt, and though he takes us by well-trodden paths and tells us little that is new or wonderful, he enlivens the way with a constant flow of time-beguiling talk and anecdote. From Egypt Mr. Baden-Powell sets out for southern Australia, but he wanders as usual off his main road for some weeks into Ceylon and India to luxuriate amid their tropic scenery and ancient monuments. Of the three southern colonies of the Australias traversed on his way to Queensland he gives us a few brief notes. Of the latter colony, where he spent some years in the enjoyable and not very arduous duties of A.D.C. to Sir Anthony Musgrave and Sir Henry Norman, he has a great deal that is interesting to tell. He visited much of the country, and saw something of its aboriginal as well as of its adopted natives, and found interest and amusement in both. At a vice-regal ball at Hughenden, a town 240 miles inland, he finds himself a fellow-guest with the butler of the hotel he was staying at, and his host's housemaid, "who was quite the belle of the ball, and who, when supper was served, turned waitress again. Such is society in a Bush town." "It was in this district," he continues, "that I first set eyes on some real wild blacks. The aboriginals of Australia are an extraordinary people. To look at they are quite unlike any other human beings I ever saw. A thick tangled mass of black hair crowns their heads; their features are of the coarsest; very large broad and flattened noses; small, sharp, bead-like eyes and heavy eyebrows. They generally have a coarse tangled bit of beard; skin very dark and limbs extraordinarily attenuated like mere bones. But they always carry themselves very erect. . . . They wander about stark naked over the less settled districts, and live entirely on what they can pick up. . . . If not the lowest type of humanity they would be hard to beat. They show but few signs of human instinct, and in their ways seem to be really more like beasts." Mr. Baden-Powell thus summarizes his opinions on Australia as a field for emigration (and those who know the Australasian colonies will recognize their truth): "The labouring man will find it a paradise; the professional man will find his profession overstocked; and the man with money to invest will probably be ruined." My personal advice to would-

be emigrants except of the lowest [? lower] class is like *Punch's*—Don't."

From Queensland it was easy and natural for our traveller to be attracted across to New Guinea, the land of so much myth and mystery. Here he fell in with the indefatigable administrator, Sir W. Macgregor, and was able to lend him a helping hand in the skirmishing incident on the capture of the natives of some villages guilty of the murder of several Europeans. He spent some days at Samarai, the head-quarters of the south-eastern district; and we feel sure that the almost unsurpassable panorama visible from its hill-set bungalow of "mountains wooded to the peak," and green isles, spread out on every side, basking in an azure sea, and picturesquely veiled in haze as they lessen away to beyond the horizon, must have rewarded him for his visit, even at the expense of a bout of fever. His account of what he saw and did in Papua occupies some eighty pages, and contains more trustworthy and interesting information than many of the narratives of men who have spent a much longer time in the country than Mr. Baden-Powell did. The next region he visited was the Malay Archipelago. He only gazed on Sumatra, "that extraordinary island which contains probably a greater variety of big game, of useful plants, and of wonderful scenery than any other country of its size"; but he visited many of the most interesting places in Java, and the Straits Settlements, and made extensive journeys in Borneo, where he shot some of "the very extraordinary-looking proboscis-monkeys (*Larvatus nasalis*) . . . I should imagine," he remarks, "his ponderous nose would get very much in the way of his biting any one, and he certainly has no other means of defence." Our space will not permit us to follow Mr. Baden-Powell through New Zealand and the various islands of the Pacific sojourned in by him, except to note his account of the preparation of "king's cava," of which he was a witness, in Samoa:—

"This was a great event. None of the Consuls even had ever before partaken of 'king's cava.' But there was a certain amount of sham about it. First, the root was produced—genuine enough, I dare say. Six men then sat in a row outside the house, the nine-legged cava bowl before them. Each man was then given some water to wash his mouth out, and a packet of cava wrapped in a bit of leaf was given to each. I shuddered at the awful thought of what was about to happen. In true native fashion these nasty old men were undoubtedly going to chew the root, and I . . . would have to swallow the nauseous stuff! I watched very carefully and was much relieved when I saw the packets collected again and put in the bowl. It was ready prepared [outside in a less orthodox and less disquieting fashion] and the little ceremony was only to represent formally the mode in which it ought to be done, the cava being 'taken as chewed.' Then the bowl was solemnly brought into the house and put on the floor at the end opposite the king."

This is an interesting instance of the evolution of what might have been as meaningless a ceremonial as are many of those survivals of abandoned customs which are familiar to us in many other parts of the world.

From Samoa Lieut. Baden-Powell made his way home by the usual route *viâ* the Sandwich Islands and through the States.

"In Savage Isles and Settled Lands" is a book we can heartily recommend. It is elegantly got up, is illustrated by excellent wood engravings, and has a map of the author's route. Nearly every page presents in a few words some bright vignette that will please and inform those who have never had the opportunity of visiting those lands and isles, and will set the home-come traveller a-dreaming with grateful satisfaction of delightful days that are past, and help him to live them over again more delightfully still in the present.

H. O. F.

PROPERTY.

Property: Its Origin and Development. By Chas. Letourneau, General Secretary to the Anthropological Society of Paris, and Professor in the School of Anthropology. (Walter Scott, 1892.)

LESS than a generation ago the history of early civilization was summed up, if not in the three words hunting, pasture, and agriculture, at least in the formula of Sir Henry Maine: "Society develops from family to tribe, and from tribe to State." Recent inquiries have discredited both of these formulas, and taken us back to the genesis of the family itself, and beyond civilization to barbarism and savagery. If we listen to Prof. Letourneau (to say nothing of Morgan and Maclennan), we may reconstruct the evolution of society in all its stages out of savagery by the "ethnographic method,"—"looking upon existing inferior races as living representatives of our primitive ancestors" (Preface, page ix). It must be remembered that in using this ethnographic method we assume that the order of progress has been substantially identical in all cases, and also that the simplest forms come first in time (p. 70, cf. 126). Both assumptions would need justification before the results of the new method could be finally accepted.

Prof. Letourneau had applied the method with great learning and ingenuity in his earlier book on the evolution of marriage. In the volume before us he applies it to property. He begins with a chapter on property amongst animals; ants and bees, as we might expect, are shown to be more highly developed in this matter than many men, and they have many of the vices of men. They provide for the future. Their property is that of a community; but one community wars on another for pillage. There are not only parasites, but idle aristocrats among them. The amazon ants, who cannot even feed themselves, but depend on their black slaves, are well known from Huber's description, and are a standing refutation of Solomon's high opinion of ants. On the whole, among animals, property is due simply to the instinct of self-preservation; and Letourneau ascribes it to the same origin in the case of men. Among the "anarchic hordes," which come first in his series (p. 23), and of which the Fuegians are a specimen, there is collective property. If union is strength it is weakness that first leads to union (cf. p. 368). But there is no personal property except in tools and weapons, "the immediate result of personal labour" (p. 39). Provision for the future is unknown. In the second stage (among the "republican tribes") the union is more highly organized; there is tribal government, with minute regulation of conduct in regard to the dealings of individuals with the necessaries of life. The most remarkable example is perhaps that of the people of Paraguay

among whom (as our author shows) the Jesuit missionaries found and did not make a system of communism (pp. 42 seq.). In nearly all the instances of this class the sense of property was most strongly developed in regard to the hunting ground of the tribe, though (in the case of the Iroquois, &c.) it embraced the Long Houses of the clans of the tribe, an anticipation of Fourier's phalansteries. The differentiation of the clan from the tribe is ascribed to the growth of the taste for property itself (cf. p. 365). Letourneau would explain the present universality of human sympathy as a bequest to us from the days when all property was common (p. 57). The republican organization passed into the monarchical, where the tribe was governed by its chief (pp. 56 seq.). This political change was rather an effect than a cause of coincident industrial changes, especially the introduction of private property in slaves and women. "A comparison of the American tribes, placing them in a graduated series from the primitive system of communistic equality upward, plainly shows that, at least in this part of the world the establishment of aristocracy and hereditary monarchic power has merely crowned an economic evolution, whereof the point of departure was the institution of slavery, and the consequent development of agriculture, whence arose the rupture of primitive equality, creation of exchangeable values, development of private property, contrast between rich and poor, foundation of castes, and hereditary succession" (p. 61). This passage, amongst others, betrays the tendency—fashionable in some quarters at the present time—to regard all social development as due mainly, if not wholly, to economic causes. Not that economists by profession are *gratæ personæ* to our author. On the contrary, they are only mentioned to be rebuked, and their doctrines only to be caricatured (see pp. 91, 96, cf. 120, 124, &c.). But, as by some sections of German Socialists, so by Letourneau, we are given to understand that the politics, religion, and general character of a society are determined by the conditions of industry and the terms of property therein prevailing, while no sufficient allowance is made for the reaction of the former set of phenomena on the latter.

To sum up: at this third stage in the development from savagery (the early monarchical system), the idea of personal property is extended from weapons and tools which a man has made, to the trees which he has planted, and then to the plot of ground he has cleared and sown. After that the idea of private property may be considered to be full formed and definitely launched on its modern career of development (p. 72). The great cause of private property is agriculture. Where there was only pasture, as with the Hottentots, the private property was only in cattle, women, and children (p. 79). Agriculture brings us to extended forms of slavery, and to forms of property and modes of valuing and exchanging it that approach more and more to modern ideas.

We need not follow our author into the *minutiæ* of his account of "primitive monarchies" and empires. He gives a survey of mankind from China to Peru, and from the earliest times to the period of Roman, feudal, and modern civilization. The earliest stages of the development are (rightly enough) treated more fully than the later, the later being the more generally known. The differentiation of clan from tribe and of family from clan, the formation of village communities for the purpose of agriculture, the introduction of inheritance, and of private property in estates, are all traced out in chapters that are full of interest even when not above cavil.

Prof. Letourneau has perhaps been too ready to point a moral for the benefit of his own generation. But after all he gives his readers the facts, and they may find their own moral, which may or may not be his. One of the best instances where the materials presented seem to justify a different moral than the one drawn from them is that of the *dessa* or village community of Java. It is pronounced to have excellent results, particularly in increasing population (p. 121), and is contrasted with "the selfish African system" (p. 122); but by our author's own account it is a combination of private and collective property, not an example of the latter by itself (cf. pp. 114, 115).

The book is, we may presume, translated from the French; and this will account for the use of "alienist" for "lunacy doctor" (p. 370), "disengaging" for "analyzing" (p. 373), and "salaried" for "wages-earning" (p. 375). But, as a rule, the language is correct and clear English.

J. B.

LEAPER'S "OUTLINES OF ORGANIC CHEMISTRY."

Outlines of Organic Chemistry. By Clement J. Leaper, F.C.S. Specially written for Schools and Classes connected with the Department of Science and Art. (London: Iliffe and Son, 1892.)

THIS little work is intended, as the title states, for the use of beginners. But the author has made the way of beginners hard, by leaving in his pages the largest collection of misprints and other slips which we recollect to have met with in so small a compass.

On the very first page, in the opening lines, there occurs a wrong formula for urea; and the book ends with a wrong formula for aldehyde-ammonia. We do not propose to convert this notice into a table of errata; but the following may be given as illustrating the sort of guidance which the beginner may expect. On p. 75, in the brief space of three lines, we meet with "$(COOH_2)$," "$C_3H_5(OH_3)$" and "$C_3H_5(OH_2)COOH$," as representing respectively oxalic acid, glycerin, and—monoformin! The blunder, in each case, consists, of course, in placing a coefficient inside instead of outside the bracket; but we doubt whether, even with this correction, the last expression, with its carboxyl-group in place of the group O.CHO, would be recognized, even by an experienced chemist, much less by a beginner, as representing monoformin.

Blunders, due to carelessness, are not confined to formulæ. Thus we find: "Pure white precipitate of silver *oxide* (p. 13), whereas the context shows that silver *chloride* is meant; "*ethene* dichloride, $C_2H_2Cl_2$" (p. 37); "lead the gas into lime water, and note the formation of insoluble *carbon dioxide* (p. 51); "by the further chlorination of methyl chloride we get *ethylidene* chloride" (p. 67); whilst, on p. 99, "grains" is twice given instead of "grams." But the worst blunder we have met with occurs on p. 109, where, possibly owing to a transposition of the pages of the author's manuscript, the explanations

which should follow Experiment 112 (Preparation of Ethyl Nitrite) have been moved on by a whole page, and made to follow Experiment 115 (Preparation of Nitro-ethane). The utterly bewildering effect of this jumble, which is enhanced by the unexpected re-entrance of the subject of nitro-ethane in the middle of a paragraph a little later on, cannot be realized without reading the passage.

The work is intended to combine practical with theoretical instruction. The selection of experiments is, on the whole, judicious, and the practical directions are generally good. This is not to be wondered at, as the author has evidently, in these points, followed pretty closely Prof. Emerson Reynolds's "Experimental Chemistry," even to such details as the substitution of a tin oil-can for a distilling flask (p. 99), or a peculiarity in the bending of a tube (p. 74), and to the reproduction of some of the illustrations—in every case without acknowledgment. Prof. Reynolds is not, however, responsible for the illustration on p. 17, in which the distillate from a Liebig's condenser is represented as falling from a considerable height into a flask placed below.

It is not true that (p. 12) "every organic compound containing nitrogen will, when fused with metallic sodium, convert the latter into sodium cyanide." Diazo-compounds do not yield any cyanide; and compounds containing sulphur as well as nitrogen form thiocyanate. Nor is heating a cyanide with excess of concentrated sulphuric acid (p. 76) a method of distinguishing it from a formate.

The author's style is occasionally slovenly, and sometimes worse: "Observe how the fact that oxalic acid so readily split up into CO, CO_2 and H_2O support (*sic*) this graphic formula for it" (p. 117).

On the whole, we suspect that teachers will prefer a text-book which calls for fewer marginal corrections.

OUR BOOK SHELF.

An Introduction to the Study of Botany, with a special chapter on some Australian Natural Orders. By Arthur Dendy, D.Sc., and A. H. S. Lucas, M.A. Small 8vo, 272 pages with about 30 pages of woodcuts. (Melbourne and London: Melville, Mullen and Slade, 1892.)

THE authors of this little work are both teachers of Natural Science in the University of Melbourne and it is specially intended for the use of students in Australia. With this object in view it would have been better perhaps to have selected common Australian types to illustrate the life history of the great divisions of the vegetable kingdom; but *Pinus* is taken as a representative of gymnosperms and *Vicia* of angiosperms. Whether these plants are both easily procurable in Australia we are unable to say, but even in that case it would have been better to have taken native plants. Possibly the preparation of illustrations may have influenced the authors, for they are largely, in the first part, "modified," "simplified," or "adapted" figures from well-known books, or they are simply copied. Taken as a whole, we do not doubt that this primer will prove useful to students, but it needs much revision to make it what it ought to be. Here and there, where we have tested it, we have found serious shortcomings. Take for example the account of the divisions of the vascular cryptogams.

"1. *Filicineæ.*—These are the ferns which constitute a very large and interesting subdivision. The full account already given of the common bracken renders a detailed description unnecessary in this place. There are two principal subdivisions of the *Filicineæ*; the homosporous, which produce only one kind of spore, and the heterosporous, which produce large megaspores and small microspores. The former include all the ordinary ferns and are again subdivided into six 'families,' of which the Polypodiaceæ are the best known and most abundant, including most of the common ferns, such as Pteris."

One would have expected a word or two respecting the heterosporous group—the *Rhizocarpeæ*, with some mention of *Marsilea*, so memorable in the history of Australian exploration; but the authors seem to have come to grief between the older and newer classifications of vascular cryptogams, for in another place (p. 90) we read of "heterosporous ferns." The definition of the *Equisetineæ* contains no reference to the spores; and the description of the *Lycopodineæ* contains no information at all. It runs thus: "This group includes the club-mosses (*Lycopodium*) and the beautiful *Selaginella*, a plant frequently grown in conservatories for decorative purposes. They are all of rather small size, and are popularly spoken of as "mosses" owing to the general appearance of the plant with its numerous very small leaves."

Comment on such a description would be superfluous. In the classification of the cellular cryptogams, lichens are altogether left out, and are apparently not mentioned anywhere. In fact the same incompleteness and inexactness pervades the book, which opens with a eulogistic preface by W. Baldwin Spencer, Professor of Biology in the University of Melbourne. W. B. H.

A German Science Reader. (Modern German Series.) Compiled by Francis Jones, F.R.S.E. (London: Percival and Co., 1892.)

THE idea of introducing to English readers extracts from the works of many well-known German scientific authorities will be thoroughly welcomed. The author has brought together sixteen very interesting articles on several branches of science, supplemented with notes, in which difficult passages are translated, and a glossary of the technical terms not usually found in dictionaries. Among the articles we may mention, Electric Telegraphs by Bernstein; Ice and Snow by Kantz; Air by Müller; Aniline Dyes by Kekulé; Spectrum Analysis by Kirchhoff and Bunsen, &c. W.

More About Wild Nature. By Mrs. Brightwen. (London: T. Fisher Unwin, 1892.)

MRS. BRIGHTWEN'S book on "Wild Nature Won by Kindness" was so widely appreciated that she has been encouraged to prepare a second volume of the same general character. It speaks well for her knowledge of animals, and for her interest in their habits, that the new sketches are written in as fresh and bright a style as if she had never before occupied herself with the mass of subjects with which she deals. She is a careful and accurate observer, and all readers who care for natural history will find much to please them in the facts and impressions she records. The author's illustrations add greatly to the charm of the text.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Arborescent Frost Patterns.

ON Sunday last, December 4, I observed a curious phenomenon, which I do not remember having ever seen before in the streets of London. Along the Euston Road, the Marylebone

Road, and other thoroughfares having an east and west direction the paving flags were all covered with a striking, vegetable-like pattern which might be most appropriately described as an arborescent tracery. The pattern was not formed of the usual small and delicate frost figures such as we are familiar with on window panes, but was made up of large and boldly-fronded designs such as shown in the sketch, which I hurriedly made on the spot :—

The "fronds" were from one to two feet in length, and often most gracefully curved. A keen wind was blowing at the time from a few degrees north of west and the flags had evidently been coated with a thin layer of mud from the previous night's rain. I attribute the pattern to the rapid freezing and evaporation of the water in this surface layer of mud which was going on during the morning. I only noticed the tracery along east and west thoroughfares ; in sheltered streets not swept by the cold wind no design was visible. The phenomenon may be known well enough to others, but by many, like myself, it may have hitherto been passed over unnoticed. My chief object in sending this description is to call attention to the very vegetable-like appearance of the pattern. If allowed to dry in a calm atmosphere and then buried under a fine alluvial or other deposit a record would be preserved which the future geologist might at first sight be tempted to read as "vegetable remains." I have seen very similar tracery in the London clay about Clacton-on-Sea and elsewhere. R. MELDOLA.

Ice Crystallites.

THE interesting facts recorded by your correspondent C. M. Irvine on p. 31 recall some unrecorded observations of my own. On several occasions during recent winters I have observed these crystallographic forms of ice on a gravel walk by the side of my lawn, in places where, owing to faulty gradients, the water does not completely drain away at the surface, and the ground just below the surface is in consequence more saturated with water than at other spots. The acicular ice-forms have appeared in bundles standing up between the pebbles and capped by earthy material, just as described by Mr. Irvine, and in previous communications to NATURE by Mr. B. Woodd Smith (see his letter on p. 79). The nature of the soil agrees with that described by these two observers, so far as permeability to water is concerned ; and I think they appeared on the occurrence of clear frosty weather after a thaw and melting of previous snow. My observations, however, extended further than theirs appear to have done. I was at the time pursuing the study of the glassy acicular *crystallites* of sulphur (which are erroneously described as "crystals" in most text-books on chemistry). These, on examination with polarized light (as I have described elsewhere) are found to be destitute of any crystalline internal structure (in fact truly vitreous or isotropic masses in spite of their crystallographic outlines) ; such structure developing, as devitrification proceeds, by crystallization in the orthorhombic system, to which the outlines of the crystallites do not conform.

In NATURE (vol. xxxvii. p. 104) is a letter from myself, recording some observations on the vitreosity of ice, as exhibited under certain suitable conditions by hailstones, and referring to a previous letter (*Ibid.* vol. xxxvi. p. 77), wherein the vitrification and devitrification of water was suggested as the possible cause of certain structural phenomena observed in them from time to time. It was with those ideas present to my mind that during recent winters I have made an examination of the acicular ice-forms referred to, which struck me as made up of unusually clear and transparent ice. On taking my microscope out of doors, fitted with a polarizing apparatus, when the temperature was a few degrees below freezing, with a thick overcoat on to prevent the heat of one's body from affecting the ice-needles, I found that, on taking them from the ground and placing them at once on the stage between crossed "Nicols," they appeared to be *completely isotropic*, as they had no reaction on polarized light. I have concluded, therefore, that these ice-needles are strictly analogous (physically) to the prismatic crystallites of sulphur ; and they resemble precisely the microscopic lathe-shaped forms, into which I have seen a perfectly clear minute plate of sulphur-glass break up in the first stage of devitrification. The explanation suggested by Mr. Woodd Smith, that they may have been formed by a slow growth of ice at their base, the molecular movement of water in the soil keeping up the supply so long as refrigeration continued, has seemed to me the most natural one ; their isotropic molecular structure is no doubt due to the rapidity of freezing owing to a sudden fall of temperature at the spot. A. IRVING.

Wellington College, Berks, November 27.

The *Volucellæ* as Alleged Examples of Variation "almost Unique among Animals."

IT is barren work for the parties in a controversy merely to deny each other's statements without adducing further evidence. Mr. Bateson first stated that var. *mystacea* did not mimic *Bombus muscorum*. I replied that it did, and the statement in my letter in no way depended on the case at the Royal College of Surgeons, but on a careful comparison of the insects in the Oxford Museum. It is useless for me to repeat that I regard it as an example of mimicry, not indeed equal to that afforded by the same fly and *Bombus hortorum*, but far better than many others which are generally believed to be instances of this principle (such as the resemblance of *Clytus arietis*, or even the resemblance—admitted by Mr. Bateson in his first letter—of *Volucella inanis*, to a wasp). I therefore propose to furnish the Editor of NATURE with photographs of the *Volucellæ* and humble-bees for reproduction, so that readers can judge of the matter for themselves. I will do my best to obtain a negative which shows the coloured bands.

Although I believed that the two London Museums supported my view, it will be obvious to any one who reads the letter that I did not rely on such support, but on my own comparison of the insects.

Mr. Bateson has offered no further evidence in support of his remarkable assertion that the variation of the *Volucellæ* is unique. I am not surprised that he should pass over this part of my letter, for I felt sure that there was no further evidence to offer. It will be remembered that this evidence was contained in the "brief statement of facts" given in his first letter, and is practically summed up in the sentence "This fly exhibits the rare condition of existing in two distinct forms in both sexes." In assuming this rarity to be so excessive that the words "almost unique" may be applied to it, and in evidently considering that we must proceed as far as the peach and nectarine in order to find a parallel, Mr. Bateson exhibits a want of acquaintance with the facts of variation which is very surprising in one who is believed to have spent some years in their study. For there is no essential biological difference between this variation and many others, examples of which I gave in my last letter, and which could easily be multiplied. In fact, many a "showcase" would have corrected such a mistake. Compared with the magnitude of this erroneous statement in Mr. Bateson's first letter, the details under discussion assume very small proportions. In considering that "no speculation is needed to enhance the exceptionally interesting facts of the variation and the resemblances of the *Volucellæ*," it would appear that Mr. Bateson seeks to replace that most invaluable servant of science, speculation, by far-reaching and unsupported assertion.

In his last letter Mr. Bateson says "it is admitted that in making this statement Mr. Poulton relied not on original authorities, but on the general impression of others." So far from this being the case I stated my belief that the impression is prevalent among those who *are* original authorities on the Hymenoptera and their parasites, and I also showed that nothing

is advanced by the authorities quoted by Mr. Bateson which can be regarded as antagonistic to this impression by any one who knows a little about the working of heredity in insect varieties.

A word about "showcases." I hope that no reader of NATURE may be led to think lightly of these as a means of instruction, and as one of the chief objects of a great museum, because Mr. Bateson states that there is a wrong identification in one at the Royal College of Surgeons, and because of the distinction which he is so careful to draw between these and other cases. Some of the most valuable specimens in the world are in "showcases." They form one of the most admirable features in modern museum arrangement, and the best material obtainable is set aside for them. This is equally true on the continent and in our own country, where Prof. Sir W. Flower and Prof. Stewart have devoted an immense amount of time and labour to this department, an important recent feature of both their museums being the illustration of the uses of colouring in animals. Prof. Lankester too is developing the same method of instruction with great success in the Oxford Museum.

It is in no way remarkable or reprehensible that four recent writers (Mr. Lloyd Morgan, Mr. Beddard, Mr. Romanes, and myself) concerned with this subject and knowing the care taken in choosing these illustrations, should also make use of some of them in their published works.

One "difficulty" brought forward by Mr. Bateson is so futile that I did not allude to it before, and only refer to it now because he repeats it. He seems to think that doubt is thrown on the theory of mimicry because *V. pellucens* does not resemble a wasp, and yet lives in its nests—as if any believer in natural selection maintained that all closely allied forms must defend themselves in the same way!

As to Mr. Bateson's statement at the end of his letter that he only intended to draw attention to the matter (and not to hurt me thereby), I can only say that this statement implies an extraordinary want of acquaintance with the niceties of the English language. It is so easy to correct mistakes without leaving anything but a feeling of gratitude in the mind of one who has made them, that, in justice to Mr. Bateson's intelligence, I am compelled to doubt the accuracy of his memory.

Oxford, November 27. EDWARD B. POULTON.

"A Criticism on Darwin."

I WRITE to protest against what appears to be a growing habit on the part of certain publishing firms of advertising their books in a most misleading manner, viz. by selecting any phrase from a notice of the book which may serve to indicate that the writer's opinion on the work as a whole is favourable, whereas, if quoted with its immediate context, the passage would prove the precise opposite. For example, I see in NATURE and elsewhere an advertisement of Mr. David Syme's book "On the Modification of Organisms; a Criticism of Darwin" (Simpkin, Marshall, and Co.), in which I am quoted as having called the writer "a shrewd critic." Standing by itself these words imply that I have somewhere recommended the work as well worthy of perusal. The fact of the matter, however, is, that the words occur in a foot-note which I added to the proof of my recently published book on "Darwin and After Darwin," for the expressed purpose "of showing the extraordinary confusion of mind which still prevails on the part of Darwin's critics, even with reference to the very fundamental parts of his theory." Elsewhere in the same foot-note I refer to the writer's "almost ludicrous misunderstandings"; and conclude by saying that he "shows himself a shrewd critic in some other parts of his essay, where he is not engaged especially on the theory of natural selection." I may now add that the only parts of his essay to which these advertised words apply are those where he treats of the deleterious effects of in-breeding.

GEORGE J. ROMANES.

Animals' Rights.

I AM not surprised that you should find my essay on "Animals' Rights" an "absolutely useless" one, for I certainly did not design it to be a congenial hand-book for the apologists of Vivisection. Nor do I the least object to your drawing what conclusions you like from the premisses laid down by me, even though you seek your justification of vivisection from the very definition that seems to me to be most clearly condemnatory of it. But, as a matter of fact, and not of personal opinion, I beg to point out that you have utterly misrepresented the leading principle of the book, and that the two contradictory definitions of animals' rights, which you attribute to *my* confusion of mind, are in reality the phantom creation of your own. On p. 9, in referring to Herbert Spencer's definition of *human* rights, I claim for animals a "due measure" (not an equal amount) of the same "restricted freedom"—a claim which by no means prohibits *all* use and employment of animals, as you conveniently assume. On p. 28 I give, not a second definition, but a repetition and amplification of the one given on p. 9; and the "due measure of restricted freedom" is explained as being "a life which permits of the individual development, subject to the limitations imposed by the permanent needs and interests of the community." Surely this is intelligible enough; yet the reviewer has utterly failed to understand it. H. S. SALT.

38 Gloucester Road, N.W., November 26.

Induction and Deduction.

MISS JONES has not quite understood me. I maintain that definitions should be *arbitrary*, but not necessarily that they should be made *at random*. If they are so made it will, as she points out, seldom happen that they turn out useful, or have any real applications, though this would not affect their logical validity if it amused any one to make them and investigate their consequences. Such definitions with no real applications are actually made by pure mathematicians. The peculiar value of the definitions of geometry consists however in the fact that they have so many real applications, and it is only by a long process of survival of the fittest that a few such happy definitions are weeded out from among the many which lead to nought. The definitions of geometry could not now be laid down at random, but they are none the less arbitrary, for they require no support from any *à priori* considerations. EDWARD T. DIXON.

Trinity College, Cambridge, November 28.

The Present Comets.

I HAVE to notice the following mistake in my letter which appeared in NATURE (vol. xlvi. p. 561). I called comet Brooks, comet "*c*." I now find it should be called comet "*d*."

I have since writing been quite satisfied that the head of comet Swift extends less towards the *n* than towards the *s* (as suggested in my letter). T. W. BACKHOUSE.

West Hendon House, Sunderland, November 26.

The Afterglow.

AFTER witnessing, with Profs. Lyon and Orr, remarkable effects of afterglow on November 27, I waited for the next issue of NATURE (No. 1205), in the expectation that similar phenomena would be mentioned as having been seen in the British Isles. Curiously enough, the letter on "Afterglow" in that issue comes from Honolulu, dated November 8. It is possible, however, that the effects of volcanic dust from one of the great eruptions of the past summer are now beginning to be noticeable in opposite hemispheres. The Krakatão eruption of August 27, 1883, appears to have caused exceptional afterglows in Honolulu on September 5, and in Western Europe by November 9, in the same year.

From the top of Killiney Hill, on November 27, at 4.30 p.m., we witnessed an extraordinary combination of cloud-effects, such as I do not remember having seen since the winter of 1883–4. On the west, dense clouds were forming upon Two Rock Mountain, and streaming down into the hollow of Carrickmines; but beyond them a clear golden sunset, passing above into green and intense blue, was visible above the summits of the hills. Fleecy cirrus clouds in the zenith were a delicate pink against clear blue, and this glow extended to all the higher cloud-masses in the east, until the sea itself became rose-pink by reflection. But in the extreme east the exceptional magenta tints, almost violet, that characterized many of the Krakatão glows, were strikingly apparent, though in part veiled by the low grey cloud of the Channel. These effects were at their maximum when the sun had set half an hour; they would doubtless have been of much longer duration but for the near clouds forming on the mountains.

One's thoughts at once turned to the great eruption of Sangir in the Philippines, which occurred, however, as far back as

June 7 of this year. Weather and locality have been against my seeing clear sunsets until to-day, when no unusual effects were noticeable; but Mr. Bishop's letter makes it possible that in other places similar effects may be observable.

GRENVILLE A. J. COLE.

Royal College of Science for Ireland, Dublin, December 4.

ELECTRICAL STANDARDS.

THE following supplementary report has been presented to the President of the Board of Trade by the Electrical Standards Committee :—

To the Right Hon. A. J. Mundella, M.P., President of the Board of Trade.

Subsequently to the presentation of our former report to Sir Michael Hicks-Beach in July, 1891, we were informed that it was probable that the German Government would shortly take steps to establish legal standards for use in connection with electrical supply, and that, with a view to secure complete agreement between the proposed standards in Germany and England, the Director of the Physico-Technical Imperial Institute at Berlin, Prof. von Helmholtz, with certain of his assistants, proposed to visit England for the purpose of making exact comparisons between the units in use in the two countries, and of attending the meeting of the British Association which was to take place in August in Edinburgh.

Having regard to the importance of this communication, it appeared desirable that the Board of Trade should postpone the action recommended in our previous report until after Prof. Helmholtz's visit.

That visit took place early in August, and there was a very full discussion of the whole subject at the meeting of the British Association in Edinburgh, at which several of our number were present. The meeting was also attended by Dr. Guillaume, of the Bureau International des Poids et Mesures, and Prof. Carhart, of the University of Michigan, U.S.A., who were well qualified by their scientific attainments to represent the opinion of their respective countries.

It appeared from the discussion that a few comparatively slight modifications of the resolutions included in our previous report would tend to secure international agreement.

An extract from the report of the Electrical Standards Committee of the British Association, embodying the results of this discussion, was communicated to us by the Secretary, and will be found in the appendix to this report.

Having carefully reconsidered the whole question in view of this communication, and having received the report of the sub-committee mentioned in resolution 14 of our previous report, we now desire, for the resolutions contained in that report, to substitute the following :—

RESOLUTIONS.

(1) That it is desirable that new denominations of standards for the measurement of electricity should be made and approved by Her Majesty in Council as Board of Trade standards.

(2) That the magnitudes of these standards should be determined on the electro-magnetic system of measurement with reference to the centimentre as unit of length, the gramme as unit of mass, and the second as unit of time, and that by the terms centimetre and gramme are meant the standards of those denominations deposited with the Board of Trade.

(3) That the standard of electrical resistance should be denominated the ohm, and should have the value 1,000,000,000 in terms of the centimetre and second.

(4) That the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14·4521 grammes in mass of a constant cross sectional area, and of a length of 106·3 centimetres may be adopted as one ohm.

(5) That a material standard, constructed in solid metal, should be adopted as the standard ohm, and should from time to time be verified by comparison with a column of mercury of known dimensions.

(6) That for the purpose of replacing the standard, if lost, destroyed, or damaged, and for ordinary use, a limited number of copies should be constructed which should be periodically compared with the standard ohm.

(7) That resistances constructed in solid metal should be adopted as Board of Trade standards for multiples and submultiples of the ohm.

(8) That the value of the standard of resistance constructed by a Committee of the British Association for the Advancement of Science in the years 1863 and 1864, and known as the British Association unit, may be taken as ·9866 of the ohm.

(9) That the standard of electrical current should be denominated the ampere, and should have the value one-tenth (0·1) in terms of the centimetre, gramme, and second.

(10) That an unvarying current which, when passed through a solution of nitrate of silver in water, in accordance with the specification attached to this report, deposits silver at the rate of 0·001118 of a gramme per second may be taken as a current of one ampere.

(11) That an alternating current of one ampere shall mean a current such that the square root of the time-average of the square of its strength at each instant in amperes is unity.

(12) That instruments constructed on the principle of the balance, in which, by the proper disposition of the conductors, forces of attraction and repulsion are produced, which depend upon the amount of current passing, and are balanced by known weights, should be adopted as the Board of Trade standards for the measurement of current whether unvarying or alternating.

(13) That the standard of electrical pressure should be denominated the volt, being the pressure which, if steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

(14) That the electrical pressure at a temperature of 15° centigrade between the poles or electrodes of the voltaic cell known as Clark's cell, prepared in accordance with the specification attached to this report, may be taken as not differing from a pressure of 1·434 volts, by more than one part in 1000.

(15) That an alternating pressure of one volt shall mean a pressure such that the square root of the time-average of the square of its value at each instant in volts is unity.

(16) That instruments constructed on the principle of Lord Kelvin's quadrant electrometer used idiostatically, and, for high-pressures, instrument on the principle of the balance, electrostatic forces being balanced against a known weight, should be adopted as Board of Trade standards for the measurement of pressure, whether unvarying or alternating.

COURTENAY BOYLE. G. CAREY FOSTER.
KELVIN. R. T. GLAZEBROOK.
P. CARDEW. J. HOPKINSON.
W. H. PREECE. W. E. AYRTON.
RAYLEIGH.

T. W. P. BLOMEFIELD, Secretary.

November 29.

ON THE PHYSIOLOGY OF GRAFTING.[1]

THE volume before us contains the record of several years of research upon the effects of different forms of grafts (using the term in its widest significance) in the vegetable kingdom.

[1] "Ueber Transplantation am Pflanzenkörper. Untersuchungen zur Physiologie und Pathologie." Von Dr. Hermann Vöchting. Mit 11 Lithographierten Tafeln und 14 Figuren im Texte. (Tübingen: Laupp, 1892.)

Opening with an historical introduction which deals briefly with the development of the art from classical times down to the present day, the author proceeds to indicate the general scope of his own investigations, and to describe the methods of experiment which he employed. The immediate problems which he sets himself to solve are contained in two questions which occur on an early page of his book, namely—Is it possible to remove parts of a given plant and transplant them to any other position in the same or a similar plant? And upon this question follows the second—What is the nature of the reaction which occurs between the newly-introduced portion and the surrounding tissues?

But although these form the proximate questions which are to be answered by means of a large number of well-conducted experiments, it soon becomes clear to the reader that the chief interest which attaches to the results obtained depends on their application to the theory of polarity of cells and tissues which Prof. Vöchting has already put forward elsewhere.

The plants chiefly (but by no means exclusively) used in the investigations were *Beta vulgaris* and *Cydonia japonica*. The former is of a fleshy and succulent character, whilst the latter is a woody plant which happens to be specially adapted to the various operations of grafting, and, as it is a perennial, it admits of the results of the experiments being watched for a considerable period of time. Prof. Vöchting distinguishes in every part of the plant between a "shoot-pole" and a "root-pole," and these he considers to be always present, however small the plant member, or piece of excised tissue, may be. The polarity manifests itself at the free surfaces, much as the effects of the magnetism of a bar magnet are visible at its ends; and moreover, just as the pieces of a broken magnet are themselves duly polarized, so also fragments of tissue exhibit relations of polarity identical with those characteristic of the organism from which they were derived.

The first precaution necessary to secure success in grafting is to respect the existences of the shoot- and root-poles, and to insert the scion in such a way as to bring its poles into due correspondence with those of the stock. Acting upon this principle it is found that, generally speaking, any member may be grafted on any other member unless there is some special reason to the contrary, such as may be connected, for example, with nutrition or water-supply. The leaf of the beet will "take" if grafted on a root, and *vice versa*, and it was also found that it was possible, in the case of roots with diarch bundles, to effect a union even when the xylem planes in the two portions were made to cross each other at right angles; analogous results were also obtained with leaves. Hence the author concludes that there is no inherent fixity in the organization of plants which predetermines a definite sequence of the chief members of which they are composed.

Experiments were made with the object of determining the mutual reactions between the stock and the scion, and the conclusion arrived at is that beyond such changes as may be referred to nutritional and similar causes, the two remain unaltered, at least in so far as their specific characters are concerned. Prof. Vöchting criticises unfavourably the various alleged cases of the so-called "graft-hybrids," and points out that even in one of the best authenticated examples, that of *Cytisus Adami*, all attempts to produce the hybrid afresh have resulted in failure.

The most interesting part of the book is occupied with the account of researches into the behaviour of transplanted portions of tissue, the direction of whose "polarity" does not coincide with that of the parts into which they are introduced. When the inserted portion of tissue is rotated on its longitudinal axis so that its own tangential surfaces are applied to the radial ones of its new host, difficulties arise in the accomplishment of a complete union, and these difficulties are further increased to a maximum when the tissue is put in upside-down, so to speak, that is with its own poles presented to *similar* poles in the stock. A great number of experiments were instituted to investigate these reactions, but space forbids any attempt to do more than briefly summarize the most important points. In the case of *Cydonia japonica* a ring of rind was cut out of a twig and replaced in the reversed direction. In many cases the twigs behaved as if the tissue had not been restored at all, simply dying, whilst in others a subsequent healing took place. This healing was accompanied by a swelling at the upper junction, together with the appearance of a ridge of tissue which was formed along the longitudinal suture of the ring from above downwards and was derived from the cambium of the ring, and not by an ingrowth of callus from the uninjured cortex of the twig, as might perhaps be supposed. In this way connection between the interrupted rind was re-established, and growth recommenced. But both at the edges of the tissue-ridge, and also between it and the original underlying xylem, the cell elements were found to be disposed in a remarkable manner, forming curved unions with the cells of the healthy tissues. For the histological details the reader is referred to the original treatise; suffice it to say that Prof. Vöchting believes that he has found in the appearances thus presented, additional evidence for the validity of his theory of the polarized condition of living tissues. He conceives of these polarities as properties which are the expression of the innermost relationships existing between the constituents of which cells are built up. He further regards the polarity of any tissue as irreversible when once the direction has been imparted to it, and he finds justification for this view not only in the details of his own experiments on grafting, but also in the results of investigations conducted by Kny and others, on the effects of compelling parts of plants to grow in a reversed position. After discussing some of the objections to his theory, without, however, disposing of them all, the author concludes by stating, with considerable reserve, some of the wider applications of his theory in explaining geotropism and other allied phenomena.

The book certainly forms one of the most important of the recent contributions to plant physiology, and the experimental details are well illustrated in the eleven plates which accompany the text, whilst the diagrams in the body of the work serve to render the author's theoretical views more intelligible. J. B. F.

NOTES.

A GOLD MEDAL is to be presented to M. Pasteur on December 27, his seventieth birthday.

ON Monday Lord Durham laid the foundation stone of a new wing of the College of Science, Newcastle, which, like the College of Medicine in the same city, is a branch of the Durham University. The College of Science was established at Westgate-hill, Newcastle, in 1871. Lord Armstrong laid the foundation stone of the present premises at Barras Bridge in 1887, and in the following year the existing wing was opened by the Marquis and Marchioness of Lorne. The success of the institution is strikingly indicated by the fact that the increase in the number of students has rendered a new wing absolutely necessary.

DR. WERNER SIEMENS, the well-known electrical engineer, died at Berlin on Tuesday. He was seventy-six years of age.

MR. W. H. PREECE, F.R.S., has been appointed a member of the Royal Commission on Electrical Communication with Lighthouses, &c., in the place of Mr. Edward Graves, deceased.

MR. W. MATTIEU WILLIAMS, who had a considerable reputation as a metallurgist and a popular writer on scientific subjects, died at his residence, near Willesden, on November 8. He was in his seventy-fourth year. Among his writings ar: his well-known books on "The Fuel of the Sun," "Science in Short Chapters," and "Through Norway with a Knapsac.k"

WE have to record the death of two distinguished Continental cryptogamists, Dr. F. v. Thümen, the well-known mycologist, formerly Director of the Chemico-Physiological Experiment Station at Klosternenberg; and Dr. C. M. Gottsche, of Altona, one of the authors of the *Synopsis Hepaticarum*, and one of the leading authorities on Mosses and Hepaticæ, in the eighty-fourth year of his age.

The Master and Fellows of Gonville and Caius College, Cambridge, have elected as Honorary Fellows the following graduates of the college:—Alexander Henry Green, F.R.S., bracketed sixth Wrangler, 1855, formerly a Fellow of the College, late Professor of Mathematics, Yorkshire College of Science, now Professor of Geology, Oxford; Arthur Ransome, M.D., F.R.S., First-class Natural Sciences Tripos, 1856, Physician to the Manchester Hospital for Consumption and Diseases of the Throat; and George John Romanes, F.R.S., Sir Robert Rede's lecturer, 1883, late Professor of Physiology in the Royal Institution of Great Britain.

AN important conference on technical education was held at Newcastle on Saturday. It was summoned by the Technical Education Committee of the Northumberland County Council. Sir M. White Ridley, the Chairman of the Council, said that the scheme of the Technical Education Committee, generally speaking, had opened out two progressive educational roads from the elementary day school onward—first, for day scholars, by means of scholarships; and secondly, for evening students by a graduated system of classes. The work in progress under that scheme had already been very extensive. As regarded agriculture, there had been courses of lectures on manuring land, poultry-keeping, farm stock, dairy work, &c. Educational courses had been given in mining, mechanics, electricity, engineering, ship-building, &c. As regarded the fishermen also, a very successful method had been adopted of teaching the men a few plain scientific facts with regard to coastal navigation, the habits of fishes, and so on. After the delivery of the Chairman's speech the Committee's scheme was carefully discussed.

PRIZES and certificates in connection with the City and Guilds of London Institute will be presented on Monday, December 12, at Merchant Taylors' Hall, Threadneedle-street, by Mr. William Anderson, F.R.S The Lord Mayor will preside.

AT the General Monthly Meeting of the Royal Institution on Monday, the special thanks of the members were returned to Mr. Ludwig Mond for a donation to the fund for carrying on investigations on liquid oxygen.

MR. STREETER held a reception on Saturday at 18 New Bond Street for the first display of sapphires from the Montana mines. At the same time an assortment of chrysoprase jewels was exhibited, and also a black diamond, said to be the largest yet discovered. Mr. Streeter also showed, among other things, a collection of different specimens of pearl-bearing oyster shell, and some curious formations of pearls in shell and loose, and in a variety of natural colours.

IN the current number of the *Geological Magazine* it is noted that Mr. Joseph E. Carne, Curator of the Mining and Geological Museum, Sydney, New South Wales, who so ably assisted the late Mr. C. S. Wilkinson during the Mining and Metallurgical Exhibition at the Crystal Palace, Sydenham, in 1890, has been appointed by the Minister of Mines to the post of Geological Surveyor. Mr. Carne entered the service of the New South Wales Government in 1879.

THE French Association for the Advancement of Science has received from an anonymous donor the sum of 600 francs, to be given in two prizes (of 400 and 200 francs), to the authors of the best memoirs containing an investigation, according to local documents, of the frequency of rabies, and the prophylactic measures in operation in a department of France, *la Seine excepted*, or in a region (two or three departments) of France or of Algeria. The statistical figures must relate to ten years at least, and comprise the results of 1892. Manuscripts to be sent to the secretary in Paris before March 31, 1893. The following points are noted for investigation:—The number of rabid animals, of dogs, of persons bitten, and dead through rabies, also of those vaccinated at the Pasteur Institute; separate the cases of rabies in large towns from those in the rest of the department; measures of sanitary police, their effect and difficulty of application; causes of more or less frequency of rabies, and of vaccination; measures taken in frontier departments, &c.

DR. B. PASQUALE has undertaken a study of the phenomena and causes of the very destructive disease of the vine known as "mal nero," his observations having been made chiefly in Sicily. The disease makes its appearance in the form of black spots and streaks on the leaves. Dr. Pasquale finds it to be always accompanied by a Schizomycete, which he believes also to be its cause, and which is parasitic, especially on the tissues rich in protoplasm and in other plastic substances, such as the cambrium, the medullary rays, the cortical parenchyma, and the soft bast of the axile organs.

THE *Botanical Gazette* states that, in a report to the Cornell University, Prof. L. H. Bailey firmly establishes the commercial value of the electric light for certain winter crops, especially for lettuce. Certain kinds of plants, which are injured by the direct rays of the light, are not injured, but may even be benefited, when the light passes through a clear glass globe or through a glass roof. Auxanometric records appear to show that the light accelerates growth, but does not change its normal periodicity. This is in harmony with the observations of Prof. G. Bonnier, recorded in the *Comptes rendus*, who finds that the electric light promotes the formation of chlorophyll in all kinds of plants, both woody and herbaceous.

THE third appendix, 1892, of the *Kew Bulletin* has been issued. It consists of a list of the staffs of the Royal Gardens, Kew, and of botanical departments and establishments at home and in India and the colonies, in correspondence with Kew.

M. EDOUARD BRANLY, Professor of Physics at the Ecole Libre des hautes études, Paris, writes to us to complain that experiments made by him are attributed to Mr. Dawson Turner in our account of "Physics at the British Association" (NATURE, August 18, p. 384). We learn that in Mr. Turner's paper, and in the condensed report furnished by him for publication, full justice was done to Prof. Branly's work. The reference to Prof. Branly was unintentionally omitted when the report was being cut down for NATURE.

MESSRS. MACMILLAN & CO. will publish immediately a new book by Professor Oliver Lodge, entitled "The Pioneers of Science." In this volume, which will be fully illustrated with portraits and diagrams, the author describes in popular language the history and progress of Astronomy. His aim has been to state scientific facts and laws as simply as possible, to present in turn a living figure of each Pioneer, and to trace his influence on the progress of thought.

DURING the past week barometric depressions have reached our western coasts with considerable frequency. As these dis-

turbances were passing away from our islands, sharp frosts occurred in the north, where the shade temperature fell as low as 13° in the north of Scotland on Thursday, December 1. The gales which accompanied the depressions were confined more particularly to the north and west. On Saturday, the 3rd instant, a large cyclonic disturbance appeared from off the Atlantic, and in the rear of this cold north-westerly winds set in with snow or hail showers generally; in many parts of the country the snow was sufficiently heavy to interfere seriously with traffic. The temperature continued to decrease, the highest daily maxima being generally below the average for the time of year, and at places in the north and north-east of our islands the maximum thermometer at times did not rise above the freezing point. For the week ended the 3rd instant the official reports show that the rainfall was greatly in excess in Scotland, and rather so in the south of England and some of the western districts; but in the eastern parts of Great Britain, and in the north of Ireland, there was a deficiency. In the south-west of England the deficiency, from the beginning of the year, is still very great, being 22 per cent. of the average amount.

MR. H. C. RUSSELL, in his presidential address to the Royal Society of New South Wales, mentions a very curious drift of a "current bottle" thrown from the Austrian man-of-war *Saïda*, about half-way between Sydney and New Zealand. This bottle found its way through twelve degrees of latitude and four of longitude to the coast of Australia, two miles north of Tweed River, where it was found just eleven months after it was thrown into the sea. Mr. Russell states that from what is known of the currents, which set strongly to the south along the coast of Australia, it seems impossible that it could have travelled direct, and that it was therefore probably carried eastward to the coast of New Zealand, and thence northward towards New Caledonia, until it got into the current setting from there to the coast of Australia; a journey of at least 2,500 miles in 335 days, and doubtless subject to many deviations which made its course longer and all the more surprising.

M. W. PRINZ, secretary of the Belgian Microscopical Society, has published an interesting paper on filiform inclusions in the quartz of St. Denis, Mons, which strangely simulate organic structures. He has at the same time discussed the origin of moss-agates, and has repeated the experiments with colloid silica and certain salts by which very similar appearances are produced. The paper, which is illustrated with a plate, is a valuable contribution to the literature of a very interesting subject.

MR. W. HOLLAND contributes to the December number of the *Entomologists' Monthly Magazine* some good practical hints on sugaring. Moths, he says, often come more readily when sugar is applied to the twigs and branches of the trees they feed upon, or twigs of something near their food-plant, than they will to sugar placed on the trunks of trees; *Xanthia citrago*, for instance, will hardly come at all to sugar put on the trunk of the lime tree; an occasional one only will be got in this way, but by sugaring below the tips of the outermost branches all round the tree Mr. Holland generally finds about fifty on one tree, besides other species. In the case of *Xanthia aurago* again, the best place to sugar is along the outside of the beech wood beneath the ends of the overhanging branches, or on the twigs of the hedge below them. Mr. Holland has repeatedly taken about 100 in a night in this way, when trunks sugared inside and outside the wood have not yielded one specimen. Other things may be got in the same way by selecting the place according to the species wanted. Among other points to which he calls attention is the necessity of recognizing early what is going to be a species of the year, for every year brings some particular kind more plentifully than usual. The sugar Mr. Holland uses is "Egyptian raw," a date sugar. This is very dark and strong stuff, sand-like, and free from lumps, and it mixes easily without boiling. He simply mixes it with beer, and then adds a drop or two of essence of pears just before starting out. There is rum enough in good sugar, and to add more is only to make the moths drop off before they can be bagged. "Jamaica foots" is a good sugar too, but it is lumpy and needs boiling. Old black treacle will do fairly well as a bait, but "golden syrup" Mr. Holland believes to be a fraud. Beet-root sugars, or refined sugars, are of course bad, and if he happens to be in a place where he can get only these, then, and then only, he adds rum.

THE second volume of the Transactions of the Leeds Naturalists' Club, to which we referred last week, includes an interesting paper on the structure and life-history of a fungus, by Mr. Harold Wager, assistant lecturer and demonstrator in biology, in the Yorkshire College, Victoria University. The paper deals with a small microscopic fungus, *Peronospora parasitica*, as a type of the fungi. Mr. Wager points out that, although in some respects this may not be the best type for the purpose, it has the advantage of having a comparatively simple structure and method of development easy to understand, and serving as an excellent introduction to the morphological study of the fungi. This type is also the more interesting because many structural details, which are fully described by Mr. Wager, have been more fully worked out in it than in any other. The paper is carefully illustrated, and the author gives a useful summary of the methods employed in the examination of the various structures he mentions.

A NOVEL utilization of aluminium is that for the construction of aluminium slate-pencils. Major von Sillich, of Meiningen, found that aluminium gives a stroke on a slate, and a German company has undertaken the manufacture of pencils based on that fact. They are 5mm. thick and 14mm. long. They need no pointing, and are well-nigh inexhaustible and unbreakable. The writing, which is as clear as with ordinary pencils, requires a little more pressure. It can be erased with a wet sponge.

A COLORIMETER for comparing the intensity of colour in a solution with a standard solution has been constructed by Papasogli. It consists of two graduated cylindrical vessels of equal diameter, through which light is transmitted from below. A vertical telescope fixed above the tubes shows the two halves of the field equally illuminated if the amounts of coloration are the same. If they are not, the heights of the liquids in the tubes can by a simple contrivance be so regulated that the colours have equal shades. Under these conditions, the concentration of colouring matter is inversely proportional to the length of the column of liquid tested.

THE Trinidad Field Naturalists' Club has held its first annual meeting, and has evidently good reason to congratulate itself on its success, which has surpassed the highest expectations of the members. Mr. Caracciolo, the chairman, in his presidential address, reminded the club that the gardens, plains, mountains, and rivers of Trinidad swarm with animal forms, about a good many of which very little is yet known.

THE latest instalment of the Transactions of the Institution of Engineers and Shipbuilders in Scotland includes the address by Mr. Robert Dundas, president, at the opening of the present session. Speaking of railways, Mr. Dundas said that a continual improvement in rolling stock generally can be noted. Larger and more commodious carriages are gradually taking the place of the smaller ones, and there is a marked increase in the application of the bogie principle, which does well, and makes an easy running carriage when properly constructed.

"Long carriages," said Mr. Dundas, "cannot be built to go round ordinary curves without either a bogie or radial axle; and between the two experience leaves very little doubt as to which is the better. The radial axle is an awkward arrangement, and does not act with the same smoothness as a well-constructed bogie with properly balanced springs to regulate its motion, and a bogie of short wheel base is not so good as a long one; the wheel base should always be more than the gauge to produce good results. There is no better test to determine what is good or bad in rolling stock than the effect on the permanent way."

A VALUABLE paper on the copper resources of the United States, read by Mr. James Douglas before the Society of Arts on November 30, is printed in the current number of the Society's journal. Mr. Douglas notes that though for many years no new copper mine has been opened, the larger and richer ones, which have been able to maintain existence in the face of depressed prices, are directing their efforts, not so much towards increasing their capacity for production as towards reducing the cost of reduction, saving, as far as possible, the precious metals associated with their ores, and securing for themselves the profits which have heretofore been made by the refining companies, to whom they sold their furnace material. "The effect of this change of policy," said Mr. Douglas, "may tell upon the market. It certainly will affect the copper refineries of this country and the continent. It would seem, therefore, that the era of rapid expansion is drawing to its close, and a healthier one of economical treatment is being inaugurated. The demand for copper is so great, that, if this policy be pursued by the large existing mines, there will be room for the appearance of new competitors, without imminent risk of over-production."

MR. W. J. L. ABBOTT contributes to the new instalment of the Proceedings of the Geologists' Association an interesting note on the occurrence of walrus in the Thames valley. *Trichechus rosmarus*, Linn., has been recorded from several places on the east coast, from the Dogger Bank, and from the peat near Ely. In the Thames valley it was discovered at a depth of 33 feet 2 inches during the excavations for the new London Docks. It was, however, considered to have "tumbled down from above," and so was passed by. In 1888 Mr. Abbott saw a tusk taken out of the gravel in the course of excavations for a wharf in Upper Thames-street; it was associated with bones of pachyderms. Although he felt sure of its identity, he was unable to procure the specimen, probably because his eagerness to obtain it manifested itself to the workman, who immediately affected that he would not part with it. Not long afterwards, in an excavation between Leadenhall and Fenchurch streets a number of bones were taken out of the gravel which underlies the peat, which in turn underlies the Roman layer. The upper part of the gravel is stained somewhat by the peat, as are the contained bones. Amongst the latter there was a large part of the skull of a walrus, with one tooth still left *in situ*, the others having been destroyed in the rough usage to which it had been submitted in bygone times. The state of preservation is seen to be exactly similar to that of the other bones found with it; while its position, Mr. Abbott thinks, leaves no question as to its Pleistocene age. He holds therefore that in future *Trichechus rosmarus* should be added to the Thames valley fauna.

AT the meeting of the chemical section of the Franklin Institute on October 18, Mr. Palmer read a note on a lilac colour from extract of chestnut. He said that in experimenting with a commercial extract of chestnut wood, with the idea of making galloflavine therefrom, he had obtained an unlooked-for result. The extract was somewhat fermented; that is a part of the tannin had been changed into gallic acid; and the design was to convert this gallic acid into galloflavine by the usual method. A solution of the 51° extract was made strongly alkaline with potash, and subjected to the action of a stream of air for about ten hours. The temperature, meantime, was kept below 50° F. At the end of the period of oxidation the potash was neutralized with acetic acid. The solution so obtained was tested for galloflavine by working therein cotton and wool yarns with the addition of potash alum. While no yellow colour was obtained, a clear, bright lilac was developed on both the animal and the vegetable fibre. The body giving this colour has not as yet been separated from the oxidized extract.

A BOOK entitled "Mind and Matter: an Argument on Theism," by the Rev. James Tait, of Montreal, has been so well received that a third edition, revised and enlarged, has just been issued (London: C. Griffin and Co.). Whatever may be said of Mr. Tait's theology, he has a good deal to learn as to the temper in which the consideration of scientific problems should be approached. It seems a little foolish, at this time of day, to talk about the "horrible plaudits" which "have accompanied every effort to establish man's brutal descent."

A PAPER embodying various suggestions to travellers was read at the June meeting of the Queensland branch of the Royal Geographical Society of Australasia by Mr. J. P. Thomson, the honorary secretary of the Society. The paper, revised and enlarged, has now been reprinted from the Society's "Proceedings and Transactions."

THE Society for Promoting Christian Knowledge has issued a new edition of "Sinai: from the Fourth Egyptian Dynasty to the Present Day," by the late Major H. S. Palmer. The little book has been revised throughout by Prof. Sayce.

MESSRS. NEWTON & CO. have issued a catalogue of science lanterns, magic lanterns, dissolving view apparatus, and lantern slides, manufactured and sold by them. The catalogue is accompanied by a supplementary list for season 1892-93.

THE additions to the Zoological Society's Gardens during the past week include a Lesser White-nosed Monkey (*Cercopithecus petaurista* ♂) from West Africa, presented by Mr. W. H. Henniker; two Great Kangaroos (*Macropus giganteus* ♀ ♀) from Australia, presented by Sir Francis Wyatt Truscott, J.P., F.Z.S.; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Miss Truefitt; a Sykes's Monkey (*Cercopithecus albigularis* ♀) from West Africa, deposited.

OUR ASTRONOMICAL COLUMN.

COMET HOLMES (NOVEMBER 6, 1892).—Computations of the orbit of this comet show now that it is an elliptic one, the period extending to 6·78 years, very nearly the same as that of Wolf Comet, 1884 III.–1891 II. The time of perihelion occurred on June 20·7357 of this year, and the comet's orbit may be mentioned as lying wholly between those of the planets Jupiter and Mars.

The following elements and ephemeris are due to Mr. A. Berberich, and are derived from observations made on November 9 (Karlsruhe), November 18 (Hamburg), and November 25 (Berlin):—

Elements.

Epoch 1892, November 25·5 Berlin M.T.

$$\begin{aligned} M &= 22^\circ\ 56'\ 3''{\cdot}6 \\ \pi - \Omega &= 18\ 12\ 14{\cdot}8 \\ \Omega &= 331\ 4\ 23{\cdot}2 \\ i &= 20\ 39\ 38{\cdot}8 \\ \phi &= 23\ 9\ 0{\cdot}6 \\ \mu &= 523''{\cdot}335 \\ \log a &= 0{\cdot}554151 \end{aligned}$$

(for $\pi - \Omega$, Ω, i): Mean Equator, 1892.0

Ephemeris. Berlin Midnight.

1892.	R.A. h. m. s.	Decl. ° ′	Log Δ.	Log r.
Dec. 8	0 45 33	+35 23·6	0·2580	0·3958
9	46 3	35 18·4		
10	46 34	35 13·4		
11	47 7	35 8·5		
12	47 41	35 3·7	0·2696	0·3981
13	48 17	34 59·0		
14	48 55	34 54·4		
15	49 34	34 50·0		

A NEW COMET (BROOKS, NOVEMBER 20).—On the evening of November 20 a telegram was received at Kiel announcing the discovery of a new comet by Brooks on November 20. Its position on November 20·875, Greenwich M.T. was given as R.A. 12h. 57m. 40s., Decl. +13° 25′. Its physical appearance was described as "circular, diameter equal to 1′, brighter than a third magnitude star, some eccentric condensation, no tail."

From observations made on November 21, 24, and 26, Prof. Kreutz has found the following elements and ephemeris, which has been communicated by a Kiel circular post-card :—

Elements.

T = 1893, January 6·953, Berlin M.T.

$$\begin{aligned} \omega &= 84° \ 24'{\cdot}5 \\ \Omega &= 185 \ 10{\cdot}7 \\ i &= 143 \ 18{\cdot}6 \\ \log q &= 0{\cdot}08130 \end{aligned}$$

Ephemeris, 12h. Berlin M.T.

1892.	App. R.A. h. m. s.	App. Decl. ° ′	Log Δ.	Br.
Dec. 8	13 28 54	+24 18·5	0·0876	2·3
12	13 39 55	28 20·5	0·0449	2·9
16	13 54 6	33 17·1	0·0001	3·7
20	14 13 17	39 19·3	9·9550	4·6
24	14 41 4	46 30·1	9·9126	5·7

A NEW COMET.—The comet which on the 24th was discovered by Mr. Freeman is now supposed most probably to be a nebula.

THE CHANNELS OF MARS.—In our Astronomical Column for November 17 we referred to the most recent hypotheses that had been put forward with respect to the doubling of the channels on the surface of Mars. Another suggestion has lately come under our notice, and this, although explaining the phenomena in quite a different way, has a point or two in its favour. This explanation appeared in the *Shanghai Mercury* on October 14, and was written by Mr. T. W. Kingsmill, the following being a brief summary of the main points :—

As Mars revolves round the sun, under the rule of gravitation, she must have tides on her surface, and since her moons are not sufficiently large to cause any sensible rise, her tides must be mostly solar. Now the best views we have of this planet is when he is in opposition, that is when we are interposed between him and the sun, so that we should always see him best at high tide. The writer then makes rather a strong point of the great eccentricity of the orbit of Mars, and the consequent heavy fall which he makes when plunging towards the sun. Situated further from the sun than we are, Mars of course must be reckoned as an older member of our system, and since he is smaller than our earth, it is only natural that his surface crust would be thicker than ours. Granting this then the internal pulp would not have such a power to compensate for this rapid fall, as our earth does internally, for there would not be much of it, so that an external compensation, assuming the crust to be too thick to alter its form, would have to take place at the surface. On the surface of course the water is the only available power, therefore we should expect, to put it in Mr. Kingsmill's own words, "that the water in the ocean would be projected into the Martial hemispheres, and as the planet approached the sun, solar tides would sweep round the planet; that the canals should sometimes appear and sometimes be duplicated . . . . is only what *à priori* might be anticipated."

Those interested in this question will be glad to hear that M. Stanislas Meunier (*Comptes rendus* for November 21, No. 21) has been continuing his experiments on this subject, which we referred to a fortnight ago. He finds now that by employing a metallic sphere instead of a polished mirror, and covering its surface with the veil as he did his former experiments the results are more striking, and bring out more clearly the phenomena really observed on the planet's surface.

ASTRONOMY AND ASTROPHYSICS.—The November number of *Astronomy and Astrophysics*, among many of its interesting articles contains one by Prof. Pickering on the lunar atmosphere, which will be read with much interest. Accompanying the article is an illustration of the recent occultation of Jupiter, at which time a dark band tangent to the moon's surface but on the planet was both observed and photographed. Prof. Coakley writes on the "Probable origin of Meteorites," the conclusions which he draws referring their origin to prehistoric lunar eruptions.

Prof. Hale, in addition to several articles on solar physics, describes generally the proposed new giant Chicago refractor, and from all accounts the observatory when finished and ready for work will be operated by simply pressing buttons; the observing chair will be entirely eliminated, the floor of the observatory, capable of motion in the vertical direction, serving the purpose. Mr. W. W. Campbell gives rather a lengthy account of his observations on the spectrum of the late Nova, and the result may be summed up in the words, "While the hypothesis of two bodies quite generally satisfies the observations, and has the further very great advantage of simplicity, there are a few not unimportant points furnished by the photographs which favour the existence of three or four bodies, two or three yielding bright line spectra and one a dark line spectrum."

A NEW OBSERVATORY.—M. S. de Glasenapp recently announced to the French Academy of Sciences that a new astronomical observatory has been erected at Abastouman, in the government of Tiflis. The observatory has been called Géorgieioskaja, in honour of its founder, and it is situated at a height of 1393 metres above the level of the sea, its terrestrial co-ordinates being latitude + 41° 45′ 43″ longitude, east of Paris 2h. 41m. 58·5s. At present it is provisionally supplied with a refractor of about nine inches belonging to the St. Petersburg University. Work has already been begun, and from all accounts the situation seems to be most favourable, many double stars measures having been obtained, which in ordinary circumstances are accounted very difficult objects with such an aperture. The observatory was opened on August 23 of this year, and up to November 5 as many as 400 double stars have been measured, omitting observations of the total lunar eclipse and of some phenomena of Jupiter's satellites.

GEOGRAPHICAL NOTES.

DR. KARL DIENER has returned to Vienna from his geological expedition in the Himalayas, which has resulted in important additions to the data available for a geological description of the great mountain system. In June the expedition commenced work in North Kumaon, crossing the Utadurrha Pass (17,600 feet), and after more than three months spent amongst the border ranges of Tibet, returned to India by the valley of Alaknanda. For a month the party never camped at a less height than 14,500 feet, and the highest summit reached was over 19,000 feet.

DR. NANSEN is threatened with a serious rival in Lieutenant Peary, who has obtained leave from the United States Navy for three years to be spent in Arctic exploration. The base of his projected journey would be the farthest point reached by him on his recent journey in Greenland, and "an incidental object" would be to reach the pole by travelling over the frozen surface of the sea which he believes to surround it.

FRIEDRICH HELLER VON HELLWALD, well known as a writer on geography and ethnology, died on November 1, aged fifty years. He was born at Padua, and grew up with an equal knowledge of German and Italian, a fact to which much of his ultimate success as an author may have been due. He was an officer in the Austrian army, but devoted most of his time to historical research and literary work. His earliest work, "Amerikanische Völkerwanderung," appeared when he was twenty-four years of age, and later he wrote on the Russians in Central Asia, the native people of various parts of Asia, the history of civilization, and other subjects. His "Die Erde und ihre Völker" formed the basis of Stanford's "Compendium of Geography and Travel." For many years Hellwald edited the geographical journal *Das Ausland*.

Captain H. L. Gallwey, vice-consul for the Oil Rivers Protectorate, gave, at the meeting of the Royal Geographical Society on Monday, a detailed account of his travels in the Benin country, of which notice has already been taken in this column (vol. xlvi. p. 65). The fact that some of the deltaic streams are clear and transparent, while the Niger water is very muddy, makes it probable that they are small independent rivers. An account of a visit to Benin city gives some idea of the decadence of native West Africa since the time of the early writers on the region, if these were to be trusted.

Mr. E. Wilkinson read a paper on the Kalahari desert, at the same meeting. It described a waggon drive through part of the desert area in company with two others, whose names were disguised under initials. Although great scarcity of surface-water was found, and the draught oxen and horses had sometimes to be watered from "sucking holes," where natives sucked up the water and filled the buckets from their mouths, the land was fairly well grassed in most parts, and Mr. Wilkinson believes it possible that it may subsequently become useful for grazing. A rough geological survey of the district passed over was made. Granite covered a large part of the surface, and appears to be the bed-rock of the whole district examined. Hard crystalline siliceo-calcareous beds and highly-altered ferruginous shales, as well as quartzite were also found, but vast accumulations of blown sand masked the true geological structure in almost every place.

The Geographical Society of California claims to have achieved "an immense success." The Society was incorporated on December 11, 1891, for "the acquisition and dissemination of scientific geographical knowledge," and has already achieved a membership of 400. Monthly lectures have been given, and a bulletin has been published. We hope that a society which has begun so well will fulfil the Latin proverb which it has adopted for its motto, "*Vires acquirit eundo.*"

THE ANNIVERSARY DINNER OF THE ROYAL SOCIETY.

THE anniversary dinner of the Royal Society was held on the evening of St. Andrew's Day at the Hôtel Métropole. It was more largely attended than any previous anniversary dinner, covers being laid for about 230. The chair was occupied by the President, Lord Kelvin. On his right were Mr. Shaw-Lefevre, M.P., Sir James Paget, the Italian Ambassador, Prof. Raoult (medallist), Sir H. Roscoe, M.P., Sir James Lister, Lord Justice Lindley, Sir B. Samuelson, Sir A. Moncrieff, Sir U. Kay-Shuttleworth, M.P., Sir C. E. Bernard, the Dean of St. Paul's, Mr. John Hutton, and Sir H. Acland. On the left of the chair were Mr. Arthur Acland, M.P., Prof. Huxley, Mr. James Bryce, M.P., the Swedish Minister, Lord Ashbourne, Sir G. Stokes, the Treasurer of the Society (Sir John Evans), Mr. Alma Tadema, Sir R. E. Welby, Mr. Herbert Gardner, M.P., Sir Godfrey Lushington, Mr. Bryant, and Dr. Mackenzie. The vice-chairs were occupied by Sir B. Baker, Prof. Roberts-Austen, Lord Rayleigh, Prof. M. Foster, Sir A. Geikie, Mr. Norman Lockyer, Dr. Pye-Smith, Prof. Vines, and Mr. Rix (assistant secretary). The first toasts were "The Queen and the Prince and Princess of Wales," and "Her Majesty's Ministers and the Members of the Legislature."

Mr. Shaw-Lefevre, in the course of his reply to the latter, said that men of science as a rule were unwilling to abandon the quiet fields of research in order to launch on the stormy seas of politics; and if they were willing, they were too philosophical to swallow the creeds of either political party. He thought that the two older Universities might help in this matter, and do more to justify their right of representation by emulating the example of the London University in returning men of science to Parliament. If there was any man in the country whose presence in the House of Commons would add to its quality and power, it was Prof. Huxley.

Mr. Acland, in proposing the next toast, said,—I have to propose to those who are here present, and who do not bear the title of "F.R.S.," the toast of "The Royal Society"—a society ancient, independent, distinguished, and most beneficent in its operations during a course of more than two centuries. Why I, a mere politician, have been selected to propose this toast I do not know. In looking over a list of the late proceedings of your society a day or two ago, I tried to discover some links between yourselves and the Education Department, over which I preside. I came across the words, "On character and behaviour," and I thought that that looked like the kind of language which we employ in our instructions to her Majesty's inspectors of schools. But it was not so. The subject to which the words had reference was "on the character and behaviour of the wandering cells of the frog, especially in relation to micro-organisms." I feel that I must fall back upon some more substantial links than that, and I fall back upon the fact that I have the honour to preside over certain institutions in which members of your society are engaged. There is the Dean of the Royal College of Science at Kensington, Prof. Huxley; and your foreign secretary, Sir Archibald Geikie; and, altogether, including those who examine for us from time to time, there are something like thirty members of the Royal Society who are connected with those institutions, and I consider it a very high honour to be linked with institutions with which they are connected. Whether some of my friends at Kensington look on their connection with the State in the same light, I do not know. When I have the honour of going over the laboratories of my friends, Prof. Thorpe and Prof. Rücker, I am inclined to doubt it. But as far as the present connection with the State goes, the Royal Society do most admirable service. They act as unpaid judges for the administration of a sum of £4,000, which the State would find it very difficult to administer on its own account; and they do the work in so impartial and admirable a manner that no man in his senses could complain. There is one other link between us. There are present here a large number of men who are interested in the work of education; and I think they will agree with me that we have one great task before us. Between the Universities and the University Colleges with which most of them are connected and the great sphere of elementary education there lies a large region, at present unorganized and chaotic, which we want to organize and bring into working order as soon as possible. There are many men of science in these colleges who often greatly regret to find willing lads, with the highest scientific capacity, brought under their notice and care, whose only lack is a lack of adequate educational preparation for their work. It is that which we want to remedy, and if I am enabled to take however humble a share in remedying it, I shall be proud of the task. We want to engage in the task of the reclamation of waste; and one of the most serious of all wastes is the waste of intellect. For those lads who go to our colleges in every part of Great Britain and Ireland we want to hold out one great possible goal—the blue riband of science—the title of Fellow of the Royal Society. You at any rate in your scientific honours have no distinction of class, and, as your medallists to-day will testify, no distinction between one country and another. You regard all as equal when you adjudge your honours to the fittest men to bear them. I connect with this toast the name of your distinguished President, Lord Kelvin. It was truly said some nine years ago, when his claims were urged for the Copley Medal, "there is scarcely a branch of physical science to the substantive advantage of which he has not contributed"; and I understand that while he has touched both the highest and the most abstruse subjects, he has not failed to condescend even to humble matters like the domestic water-tap. Among those of you who know far better than I do what Lord Kelvin has done, both for abstruse science and for the welfare of mankind, there can be no limit as to the value of his work to future generations. I am sure that he himself cannot possibly say how great the value of what he has done may be in the far-off future. But I understand from Sir Archibald Geikie that your president has attempted to put a limit to the inquiries of the geologists, when they look into the backward past. He has definitely said that in looking backwards they must not go beyond the moderate limit of twenty million years. I understand that this is a grievance on the part of the geologists, but I hope that the President will not give unnecessary pain to his geological friends. In the draft of the preamble of your charter—it was drafted by Sir Christopher Wren—it was said Fellows of the Royal Society, by "their labours in the disquisition of nature, would try to prove themselves real benefactors of mankind." I give you the toast of "The Royal Society," coupled with the name of Lord Kelvin, and I assert that your present President has done his part in proving himself a benefactor of mankind.

The Chairman, in replying, said,—I thank you very heartily for the kind manner in which you have received this toast. I feel the honour you do me, but I also feel my incapacity to say

what ought to be said for so great an institution. I can only say in my own way that I believe the Royal Society, as an institution, has up to the present time persevered in well-doing, and had been successful in its efforts. The Royal Society has certainly endeavoured to carry out the objects of its institution—namely, to inquire into natural knowledge and the improvement of it. The mode of carrying out that object was carefully considered, no doubt, by those who founded the Royal Society; and they determined to hold regular meetings, partaking somewhat of the character of a debating society—meetings where discussions could be raised by questions presented, and the truth arrived at thereby. That object has been carried out from the inception of the Society to the present day; and the society has been imitated by other societies over a large part of the civilized world. Indeed, the Royal Society itself only followed in the path of other learned societies in Italy, which had determined that by personal discussion of questions in regular meetings truth might be arrived at which otherwise might be lost. We often find complaints that meetings of scientific societies are unsatisfactory. We have even complaints that the important duty, the publication of their proceedings for the rest of the world, is not altogether ideally perfect. Some who desire the progress of science above all, and heartily wish success to the Royal Society, think that the society ought to be a body for merely recording and indexing the work that has been done all over the world. That is a part of the work of the Royal Society which is not neglected. The council has had most anxious, careful, and laborious consultations from year to year with reference to this work—not only as to the publication of its own transactions and proceedings, but as to the cataloguing and indexing of the proceedings of scientific bodies and scientific workers all over the world. One very important part of the work of the society consists of the cataloguing of all scientific papers published; and a very dry and fatiguing subject it is to work upon. The difficulty here is *embarras de richesses*. To get the titles only of these papers is itself a truly Herculean task. If the Royal Society had not only capacity, but had also great funds at its disposal, it would make short work of this task. It would not only index, it would publish the papers: and would put them in such a form that any one could find his own particular subject at once, and the particular volume and page in which it was treated. This is an exceedingly difficult subject, but the first necessity is funds, and if those were supplied all the rest would follow. The publishing and indexing, however, is not the only work of the society. The life and soul of its work is in its meetings and discussions, and whoever has not felt the stimulus of attending those meetings has hardly yet found out the spirit of scientific enquiry. For myself, I say the fact that we can attend meetings of the Royal Society, and hear papers on subjects very far removed from the subjects of our every-day work, is a stimulus which is of the highest value. The worker who has heard what other people are doing goes back to his work with something which may help him in it, which, at any rate, brightens his life, and makes the drudgery and heavy work necessary for success in any scientific investigation less irksome and dry. For myself I may say that my connexion with the Royal Society, extending over a great many years, has been one of unmixed benefit and pleasure, and has given to me some of the happiest of those pictures of knowledge and memory the possession of which constitutes so much of the delight of life. Mr. Acland remarked upon my having been hard upon the geologists. I do not think that I have actually been so. I do not believe in one science for the mathematician, another for the chemist, another for the physicist, and another for the geologist. All science is one science; and any part of science which places itself outside the pale of the other sciences ceases for the time being to be a science. The sooner it returns to the pale of the other sciences the better; and when all are working for a common good the better it will be for the progress of each.

Prof. Huxley, in proposing the next toast, said that he had to discourse on the merits of the gentlemen to whom medals had been awarded. There was one the adequate treatment of whose merits would occupy the whole available time; and yet Mr. Shaw-Lefevre wished him to say something about his capacity to become a legislator and also to give an opinion upon geological time. He would answer the first interrogation by telling a story. When he was a very young man a solicitor in large practice discovered in him what that gentleman believed qualities that would command success at the Bar, which he had never discovered himself, and proposed to advance him an income for a certain number of years until he could pay the amount back out of the fees he was sure to earn. He was sorry to say his reply was this, "So far as I understand myself, my faculties are so entirely confined to the discovery of truth that I have no sort of power of obscuring it." With regard to political life, the absolute contradictions that were made by politicians of opposite sides upon matters of fact were absolutely fatal to his chances in a political career. Coming to the subject of the toast, he narrated the history of the Copley medal. A bequest of £100 was left to the Society 188 years ago by Godfrey Copley, a Fellow of the Society, for improving natural knowledge. The medal was thrown open to all the world, a step much disapproved by certain narrow-minded persons at the time; but that step was the real reason why, a century later, Sir Humphry Davy could really call it "the ancient olive crown of the society." The value of the medal was originally fixed at £5, people being able to get five per cent. for their money in those halcyon days. He did not like to dwell upon its appreciation now lest the County Council should put in a claim for unearned increment. The medal had certainly done nothing for itself; the appreciation of its value had arisen entirely from surrounding circumstances, the chief being the wisdom and integrity of some eighty successive councils. A complete list of the awards was published every year. Going back one hundred years from 1887—he had a reason for not taking a later date—the century began with John Hunter, and finished with Joseph Hooker. Between them was a galaxy of the heroes of science, French, German, Scandinavian, Italian, American, and English; and, although one star might differ from another star in glory, none was unworthy of its place in the constellation. The present council had not fallen below the standard of its predecessors; there was no biologist, no scientific physician, no anthropologist, no archæologist to whom the name of the illustrious Rector of the University of Berlin, Rudolph Virchow, was not familiar. No one had done more to put pathology on a scientific foundation; no one had done more for critical anthropology, especially in connection with archæology. Without venturing on the dangerous field of politics, he would add that these merits were, to his mind, greatly enhanced by the fact that Virchow had never merged the citizen in the philosopher, but amidst great difficulties and with undaunted courage, he had taken an active, a disinterested, and a thoroughly independent course in the Legislature of his country. The next medal in order of age was that founded by Count Rumford at the commencement of this century, on equally cosmopolitan principles, but limited in scope to the physico-chemical sciences. In these sciences hardly anything had attracted popular attention more of recent years than the marvellous power which spectroscopy had placed in our hands to discern the chemical composition of bodies which were millions and billions of miles away; and, for anything we knew to the contrary, these minute and careful inquiries into the constitution of stars might be *post-mortem* examinations. In the accurate examination of stars by the spectroscope, he understood from others that Dr. Dunér, of Sweden, had laid secure foundations for all future investigations. The Royal medals were founded by the Sovereign some sixty-odd years ago, were now maintained by her Majesty, and were confined to British subjects. There were two medals every year, and they were usually allotted one to physical and chemical science, and the other to biological science. They were usually given to younger men; and it was so in his own case forty years ago. The value of the medal was inexpressible to him. In his younger days, if a man took to science, it was thought he was going to the bad. The receipt of the medal made an entire revolution in the minds of his friends; and he was a respectable person from that time. On the present occasion the first of these medals was awarded to the present Director of the Astronomical Observatory in Oxford, Prof. Pritchard, and he was told that there was no observatory in the three kingdoms in which so much admirable work of observation was being done. Only a short time ago the Royal Astronomical Society awarded its gold medal to the Director of the Oxford Observatory. He was further told that the director was tackling what he understood was one of the most difficult pieces of astronomical work—parallax determination; and that he had already printed off more stars than anybody else. Besides this, he was hard at work on the great international chart of the heavens. It was obvious that this gentleman must be in the

full vigour of youthful energy, and therefore he treated with contempt a rumour that had reached him that the director was in his eighty-fourth year. They would join with him in wishing Prof. Pritchard a long continuance of the health and strength which were turned to such splendid account. The second of these medals was awarded to Dr. Langley, of the University of Cambridge, for the long-continued and very valuable physiological researches. There was a familiar phenomenon observable before sitting down to dinner, and known as watering of the mouth. If it were possible to determine the exact condition of that operation in physiology the exact knowledge would be a key to an immense range of the secrets of Nature. It was these problems that Dr. Langley had been investigating, and he had come nearer to their solution than any one else. The Davy medal was awarded to a distinguished French *savant*, M. Raoult, whose work was considered of the highest importance; and he rejoiced that the recipient of the medal was present. The Darwin medal was instituted in honour of one of his best and dearest friends, and it was now conferred upon a man who was one of the stanchest friends he had had for the last forty years. He might fairly appeal to Sir Joseph Hooker's present activity, put him down also among the young men, and thereby save the credit of the council in the matter of its own regulation. To those who knew the "Life and Letters of Darwin," talk about Sir Joseph Hooker's right to the Darwin medal was as futile as the attempt to judge Manlius in sight of the Capitol. He knew no more remarkable example of life-long devotion, of stores of information laid open, of useful criticism, and of still more useful encouragement, by one man to another, than that exhibited by Sir Joseph Hooker in this picture. It might be that even the man whose motto was "It's dogged as does it," and who so patiently laboured for half a lifetime at the great fabric of the origin of species, might have fainted by the way without this friend's aid. And assuredly Hooker's great study of geographical distribution was a most important factor in Darwin's work. It lay in the eternal fitness of things that Wallace and Hooker should receive the Darwin medal; and that these old young-men should give it a heightened value for the young young-men to whom it would hereafter pass.

Prof. Raoult returned thanks, speaking in French.

Dr. Langley responded for the other medallists and himself.

Sir James Paget briefly proposed "The Guests."

The Swedish Minister, in responding, said—The honour to be your guest and to participate with you in the celebration of this interesting day cannot be more thankfully felt than by me, who still has to consider this favour, above all, as a compliment to the country where you have selected this year your Rumford medallist. This distinction to my fellow-countryman, Prof. Dunér, whose merits Prof. Huxley has so eloquently explained to you, is a new link in the long chain of tokens of sympathy and appreciation from this society to scientific Scandinavians, a chain of which one of the oldest links is the creation of the Linnean Society. More than a hundred years have passed since, and in the meantime many systems have been altered; and, especially in the last twenty years, those alterations have so closely followed the one upon the other that we laymen have been accustomed to believe we were entitled to ask every new morning, "What great discovery will this day bring?" In one department, however, scientific men as well as laymen cannot admit the possibility of any alteration, and that is in our conviction and belief that this country occupies a prominent place in the universal scientific movement—a proof of which, among many others, is the fact that no other institution in the world encourages as much as does this society other countries' scientific researches.

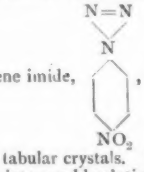
Mr. Alma-Tadema also responded, remarking in the course of his speech that there was no art without science, neither was there any science without art: and that art coloured life as the sun colours the flowers of nature.

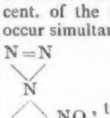
AZOIMIDE.

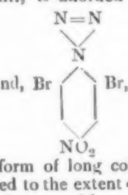
A FURTHER communication concerning azoimide, the interesting compound of hydrogen and nitrogen, N_3H, discovered two years ago by Prof. Curtius, is contributed to the current number of the *Berichte* by Drs. Noelting and Grandmougin of Mülhausen, in conjunction with Herr O. Michel. As described in our note of vol. xliv. p. 600, Drs. Noelting and Grandmougin have previously shown that azoimide may be obtained by indirect means from the singular compound prepared somewhere about the year 1866 by the late Dr. Peter Griess, and which has hitherto been known as diazobenzene imide, $C_6H_5{-}N\Big\langle\begin{matrix}N\\ \|\\ N\end{matrix}$. This compound is now recognised as the phenyl ester of azoimide. It is, however, a substance of very considerable stability, and successfully resists the attack of concentrated alcoholic potash, even under pressure. Although thus stoutly resisting direct attack, Drs. Noelting and Grandmougin have shown that by undermining its constitution by the introduction of a couple of nitro groups in the place of two hydrogen atoms, it becomes weakened so greatly as to be no longer capable of withstanding the action of the alkali, and is decomposed with production of the potassium salts of azoimide and dinitro-phenol—

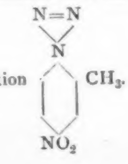
$$C_6H_3(NO_2)_2N_3 + 2KOH = C_6H_3(NO_2)_2OK + N_3K + H_2O.$$

This interesting result is now supplemented by showing that it is not necessary to introduce *two* nitro groups in order to render diazobenzene imide sufficiently negative in character as to be susceptible to the attack of alcoholic potash, that *one* such group suffices, provided it be introduced in the para or ortho position. A nitro group introduced in the meta position appears to exert much less weakening power, quite inadequate for the purpose.

Para nitro diazobenzene imide, , is a substance crystallizing well in colourless tabular crystals. When these crystals are allowed to fall slowly into a cold solution of one part of caustic potash in ten parts of absolute alcohol, they instantly dissolve and the liquid becomes coloured a deep red. If this red solution is warmed for a couple of days over a water bath, and the larger portion of the alcohol subsequently distilled off, upon acidification of the residue with dilute sulphuric acid, and again distilling, azoimide, N_3H, passes over along with the vapours of water and alcohol. In order to free the azoimide from alcohol it is only necessary to neutralize the distillate with soda, and evaporate the solution to dryness, when the sodium salt of azoimide, N_3Na, is obtained; the sodium salt is then dissolved in water, the solution acidified with sulphuric acid, and subjected to distillation, when an aqueous solution of azoimide is obtained. The yield of azoimide is usually only about 40 per cent. of the theoretical, owing to secondary reactions which occur simultaneously with the main one. The ortho compound,



treated in a similar manner, also furnishes azoimide to the extent of about 30 per cent. A very much larger yield, about 85 per cent., is afforded by the dibrom derivative of the para compound, , a substance which is readily obtained in the form of long colourless prisms. Azoimide has also been obtained to the extent of 30 per cent. of the theoretical amount by the decomposition of a nitro toluene derivative of azoimide of the constitution



THE NEW STAR IN THE CONSTELLATION OF AURIGA.[1]

THE appearances which the new star has presented were exceedingly remarkable, and observations, both spectroscopic and photometric, were far more numerous than have been obtained during former occurrences of this kind. The latter have been sufficient to establish the unsuitability of several explanations which have been suggested with regard to former new stars, suggestions which at the time appeared more or less plausible. On the other hand, however, it is very difficult to establish, from the publications of observers up to the present time, all details required for a general proof of a definite hypothesis. It appears to me appropriate to suggest a new attempt at explanation, which seems to tally better than others with the principal results of observation, the final tests of which hypothesis must, however, for the present remain a matter for the future. But if this attempt should in the present instance meet with difficulties—a case which I admit to be possible, if not probable—it yet deserves a somewhat more detailed explanation, because it thoroughly takes account of, as I believe, possible conditions, and therefore certainly contains a possible hypothesis with regard to the appearances of certain new stars. In the following remarks I shall strictly adhere to the facts which are to be considered, according to the statements of the observers, as the result of their observations, whereas a proof of the latter is beyond the limit of this article. I may here mention that I have already suggested the most essential of the following remarks in March of the present year.[2]

The chief results of observations, which may be said to contain the characteristics of all the appearances, are :—

1. According to Herrn Lindeman [3] the light-curve of the Nova presented the following appearances :—

"From February 1 to 3 the photometric curve rises quickly to a brightness of 4.7m., then gradually sinks till February 13, and then quicker until February 16 to 5.8m., reaches a second maximum of 5.14m. on February 18, has a second minimum on February 23, likewise of 5.8m., and then a third maximum on March 2 again of 5.4m., upon which it sinks till March 6, slowly at first, and then quicker, in a straight line till March 22 down to 9.3". I may here add that from the photographs taken at Harvard College, it was possible to show that the star became visible from the beginning of December, 1891, that already in the period of time December 20–22 it showed a maximum of brightness which reached almost, but apparently not entirely, a maximum on February 3.

2. The spectrum of the Nova was most remarkable. Prof. Vogel, in summing up the results obtained at Potsdam,[4] writes :—

"The observations have led to the exceedingly interesting result that the spectrum of the Nova consists of two superposed spectra, and that a number of lines, especially those of hydrogen, which appear bright in one spectrum and dark in the other, are closely adjacent to one another. This fact admits of hardly any other explanation than the presence of two bodies, the component motions of which in the line of sight are very considerable . . . The bodies separate from one another with a relative velocity which during four weeks' observations (in February) suffered no appreciable change, and which amounted to at least 120 miles per second." It may be further added [5] that among the very broadened bright lines there were noted several intensity maxima, two being especially striking.

It has been suggested as an explanation of the facts of observation that two heavenly bodies have passed very close by one another, and that thus changes in their atmospheres have arisen which have caused the sudden brightening up of the bodies. The above hypothesis is, however, in this form too vague to be followed in detail. In reverting to an idea of Klinkerfues, it is true that a more distinct picture of the whole occurrence has been drawn, by assuming tidal effects of the two bodies upon each other : in this manner where the tidal crests of the atmosphere appear, there the darkenings take place by absorption, and where the ebb predominates a brightening is the result, because here the absorbing strata of the atmospheres are less powerful. It must be mentioned, however, that the statical theory of Ebb and Flow that has been applied is altogether inappropriate to give an idea of the deformations which doubtlessly occur at such a near proximity. The effect of the two heavenly bodies on each other in Nova Aurigæ, as is still to be shown, would have to be one that is almost always suddenly appearing and immediately afterwards vanishing. Moreover it must not be overlooked, that with incandescent bodies their atmospheres must be regarded as outward shells which quite gradually emerge into denser strata, while these also are deformed in a lesser degree. In other respects, too, it will be difficult to explain the appearances of a new star as a consequence only of the effects of absorption of atmospheres. It has also been assumed for the most part that besides these (absorptions), eruptions of gas from the centre of the body take place. This assumption, it is true, contains nothing impossible, but without a definite form it hardly admits of discussion. At all events it will be necessary to suggest further hypotheses in order to apply this attempt at explanation to single cases. Moreover, it remains yet unexplained why in Nova Aurigæ the one spectrum is chiefly an absorption spectrum and the other a gas spectrum. By special assumptions this difficulty can be certainly eliminated, but it is not very probable that on this account confidence can be placed in the correctness of the hypothesis.

Other facts appear, however, in the case of Nova Aurigæ which do not speak in favour of this hypothesis, however generally it may be expressed. It is at least very striking that just in this case such enormously great velocities of cosmical bodies appear, such as have hitherto not been found anywhere else. The occurrences of these velocities must therefore be numbered among the facts to be explained. Further on formulæ will be given from which, at least to a certain degree, the mechanical conditions of the close approach of two bodies can be computed. From this it follows that in the case of Nova Aurigæ the two bodies can describe a parabola round each other only if their masses are much larger than 15,000 times the sun's mass. For a hyperbolic movement one can obtain an essentially smaller value of the mass, by assuming that the enormous relative velocity of 120 miles observed has been produced to a small degree by attraction and has existed almost entirely from the beginning. Thus the choice is left between the assumption of extremely large masses or the giving up of an explanation of the great relative velocity. Neither of these two assumptions contain, it is true, an impossibility, but I do not think that doubtful proofs for the correction of the hypothesis can be noticed in either of them. According to my opinion they rather render it (the hypothesis) very little plausible.

The formulæ already mentioned indicate what will be explained further on, namely, that the supposed effect of the two bodies, in the case in hand, must have taken place very quickly indeed, perhaps even in the period of a few hours. This effect must necessarily have occurred upon the first brightening up (beginning of December 1891). Why then the Nova attained several weeks later (beginning of February 1892) a second maximum, and to all appearances a greater maximum, and why the light-curve sank only very little till the beginning of March but afterwards very rapidly, seems to me, on the ground of the hypothesis in question, to be explainable only with great difficulty, if it can be explained at all. At all events, this difficulty will remain unless it be altogether removed in detail.

The difficulties hinted at above entirely disappear in the following supposition. There is no doubt, especially in accordance and with the results obtained from stellar photographs, in which Mr. Max Wolf has co-operated, that space is entirely filled with more or less extensive formations of very thinly scattered matter. With regard to their physical properties, these formations will probably show very varied constitutions, the reason for which we will leave an open question, as we do not wish to investigate it here. It is itself not very improbable that a heavenly body should get into such a cloud, but in any case it is more probable than the grazing together of two compact bodies, as is required in the above-discussed hypothesis. As soon now as the body commences to enter a cosmic cloud a surface heating will be set up at once, and indeed it must be so, whatever may be the constitution of the thinly-scattered matter. In consequence of this heating, the products of vapourizaation will form round the body ; these will partly be separated

[1] Translation of an article by H. Seelinger, in *Astronomische Nachrichten* (No. 3118).

[2] "On a General Problem of the Mechanics of the Heavens," p. 23. (München, 1892.)

[3] *Astr. Nach.*, No. 3094.

[4] *Vierteljahrsschrift der Astr. Gesellsch*, Band 27, p. 141.

[5] *Astr. Nachr.*, 3079, p. 110.

from it and will adopt very quickly that velocity which the adjacent parts of the cloud possess.

It is interesting to compare this process with a similar one, which takes place in a well-known way in the appearance of shooting stars or fireballs. In this case a compact body enters with a certain velocity into a formation of very thin matter (the upper strata of the atmosphere), is heated and partly vapourized, and a luminous tail, which is clearly visible for a long time after the sudden appearance of the meteor, marks the path which the latter has taken. The detached particles have quickly lost their relative velocities against the air, for they apparently do not partake of the movement of the meteor.

If we consider spectroscopically the star on its commencement to become bright by resistance, two superposed spectra will openly reveal themselves, one in general continuous and provided with absorption bands in consequence of the heaping up of the glowing gases, and the other in the main consisting of bright lines. Both spectra, according to the relative motion in the line of sight, will appear pressed up against one another. Thus altogether an appearance is found very similar to that observed in Nova Aurigæ, and they will agree entirely if one assumes that also those parts of the cloud nearest the body have sustained physical perturbations by a direct frictional warming of the detached particles, &c. This assumption seems to me to contain by no means a difficulty considering our lack of knowledge with respect to the properties of this cloud matter. Whether this is at all necessary I am unable to say on the ground of the publications at hand.

The investigation is important to decide whether, on the lines laid out, we can obtain a plausible explanation of the great relative velocities shown by the two spectra. When the body approaches the cloud the latter will evidently lengthen itself in the direction of the former. This lengthening will grow with the mutual approach, just as the relative velocity of the single parts of the cloud will grow towards the body. Without certain suppositions on the structure of cloud matter it is difficult to conceive of the processes of movement which take place, so we must content ourselves with contemplating the one or the other case, which admits of a closer investigation.

If, for instance, we suppose that the single particles of the cloud follow for the main part the effect of the body, they will describe conic-sections—that is, hyperbolas round the centre of the latter as forces. Their greatest relative velocity decreases quickly with the distance of the body, so that the surroundings of the latter will be filled with particles moving with very different velocities. One can easily see that no very extraordinary assumptions are necessary to suppose very great velocities for these particles that pass near the surface of the body, velocities amounting to those stated in the case of Nova Aurigæ, even if they are at the outset very small. It follows from the above that the spectral-lines of the particles which are moving from the body with such different velocities must be very much enlarged, and that to explain the different brightenings of the single parts of the lines as probably intensity maxima does not raise the least difficulty, but is a necessary accompanying phenomenon. This point seems to me to be important, for it cannot be deduced from the hypothesis of two compact masses passing close by one another, and must here lead to the rather improbable assumption of several moving bodies.

As long as the body remains in this, so to speak, atmospheric formation, the appearances above mentioned must always be called forth anew, whence it follows that the peculiarities of the spectrum conditioned by the whole state of things, not considering smaller perturbations, must on the whole remain constant for some time, a point which in the above hypothesis is at first not by any means clear. In a similar manner it will not be astonishing if the star during that time changes its brightness less strongly, while after its exit from the cloud this brightness will decrease rather rapidly. This too agrees with the light-curve in the case of the Nova. Finally, even the periodical fluctuations of the magnitude can be explained quite naturally. We call to mind here the well-known fact confirmed lately by the photographs of Max Wolf, that similar occurrences appear in shooting stars, which may, indeed, be explained with difficulty.

We must, however, in any case assume that the star entered the cosmical cloud in question about the beginning of December and left it not long before the beginning of March. Now the question is urged upon us How was it possible that for such a long time the great relative velocity could remain constant though such a resistance must have taken place that could develope the heat necessary for the glowing of the body? We are here going to decide this question by comparing the resisting power of the star to that of a meteor in the upper strata of our atmosphere.

Let us assume, quite generally, that the motion of the star in a straight line is given by the equation

$$\frac{dv}{dt} = -lv_n \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; . \;)1)$$

(1) where v is the velocity, n a positive number $>$ 1 and λ a constant, which is directly proportional to the surface of the globular body and the density of the medium and inversely proportional to the mass of the body. We compare equation (1) with the equation for the motion of a meteor

$$\frac{dv'}{dt'} = -\lambda' v'^n$$

in which the time t' is referred to another unit selected for the purpose. If we suppose $v' = \mu v$; $t' = \nu t$; $\lambda = \lambda \nu\mu^{n-1}$. The latter equation becomes identical with (1), that is the movement of the star corresponds point to point with the motion of the meteor, if the latter equations are satisfied. Representing now m, O, r, δ, m', O′, r', δ', as masses, surfaces, radii, and densities of the star and meteor, and D and D′ the density of the cosmical clouds and the upper strata of the atmosphere in question, we have :—

$$\frac{\lambda}{\lambda'} = \frac{\mathrm{D O} m'}{\mathrm{D' O'} m}\;;\; \nu \quad \frac{1}{\mu^{n-1}} \cdot \frac{\mathrm{D O} m'}{\mathrm{D' O'} m}.$$

or also

$$\nu = \frac{t'}{t} = \left(\frac{v}{v'}\right)^{n-} \cdot \frac{r' \delta' \mathrm{D}}{r \delta \mathrm{D}'}.$$

If we put $r = k$ times the sun's radius (= 700 million metres) and $r = r'$ metres, and further corresponding to the observations of the new star $v = 30$ (unit of velocity of Earth in its orbit) and $t = 100$ days and $v' = 2$ which corresponds to a relatively quickly-moving meteor and finally $n = 2$, we have :—

$$\nu = \frac{15}{k} \cdot \frac{\mathrm{D}\delta'}{\mathrm{D}'\delta} \cdot \frac{r'}{700 \text{ millions}}$$

$$\text{and } t' = 0^s.\ 185 f\;;\; f = \frac{r'\delta'\mathrm{D}}{k\delta\mathrm{D}'}.$$

Thus the movement of the star takes place proportionally in 100 days, just as that of the meteor in 0·185 seconds if we suppose $f = 1$. As we are free to assume $\frac{\mathrm{D}}{\mathrm{D}'}$ small, we can obtain a very small fraction of a second, and since within a hundredth part of a second the movement in the highest regions of our atmosphere shows no longer a perceptible decrease of velocity, such a decrease will not enter in the case of the star. We have evidently to deal here with the same appearance which points out that small heavy objects possess a far greater resistance to air than large ones, and that with large meteors (fireballs) the air resistance, as it has been proved, influences the elements of the orbit far less than is the case with small meteors.

We have still to show that in spite of the small decrease of movement, enough energy of movement is changed into heat in order to bring the star into a surface-glowing condition, and such a condition has by all means taken place in the Nova. We must therefore calculate the quantities of heat Q and Q′ which is radiated in one second of time, and from a unit of surface on both bodies. If we call P and P′ the losses in acting power during the times t and t', v_0 and v_0' the velocities before the entrance into the resisting media, we have :—

$$\mathrm{Q} = \frac{\mathrm{P}}{\mathrm{O}t}\;;\; \mathrm{Q}' = \frac{\mathrm{P}'}{\mathrm{O}'t'}$$

$$\text{and } \mathrm{P} = m\,(v_0^2 - v^2)\;;\; \mathrm{P} = m'\,(v_0'^2 - v'^2)$$

and taking into consideration the above equations :

$$\frac{\mathrm{Q}}{\mathrm{Q}} = \frac{\mathrm{D}}{\mathrm{D}'}\left(\frac{v}{v'}\right)^{n+1}$$

with the above numbers $\frac{v}{v'} = 15$; n will be $= 2$

$$\frac{\mathrm{Q}}{\mathrm{Q}'} = 3375 \cdot \frac{\mathrm{D}}{\mathrm{D}'}$$

so that we can assume that the density of the cosmic medium, compared to these already very thin air strata, in which evidently

the glowing of the meteor occurs, is not very dense, and that one yet gets the necessary quantity of heat.

It may be remarked that we can vary all these numbers within very wide limits without fearing any contradiction, so that we may conclude, therefore, that no difficulty in the suggested hypothesis arises from this point of view.

I have now to deduce the formulæ I have mentioned above, and it will be seen that these are very interesting.

If we take μ as the sum of two masses revolving round each other in a conic section, V the velocity, and retaining for the rest the customary nomenclature, we have for the parabola

$$V^2 = k^2\mu \cdot \frac{2}{r}; \quad r = \frac{q}{\cos^2 {}^1/_2 v};$$

$$\tan \tfrac{1}{2} v + {}^1/_3 \tan^3 {}^1/_2 v = \frac{k\sqrt{\mu}t}{q^{3/2}\sqrt{2}}.$$

Whence it follows without further difficulty:

$$\mu = \frac{V^3 t}{4k^2 \sin {}^1/_2 v\,[1 - {}^2/_3 \sin^2 {}^1/_2 v]}.$$

One takes c as the velocity of the earth in its orbit with the radius R and puts the sun's mass and the mass of the earth $= 1$, so that $k^2 = c^2 R$. If we consider further that the expression

$$\sin {}^1/_2 v\,[1 - {}^2/_3 \sin^2 {}^1/_2 v]$$

can attain the maximum value $\frac{\sqrt{2}}{3}$ it follows that

$$\mu > \frac{3}{4\sqrt{2}} \cdot \left(\frac{V}{c}\right)^3 \cdot \frac{ct}{R}.$$

or if c be given in solar days

$$\mu > 0{\cdot}009123\left(\frac{V}{c}\right)^3 t. \quad \dots\dots \quad (4)$$

To apply this to the Nova we must remember that $\frac{V}{c} > 15$ because the orbital velocity may be greater than that in the line of sight. Besides, more than two months have passed since the supposed grazing of the bodies took place, which time must coincide closely with that of perihelion, up to the time that we have still spectrum observations in hand. Thus t is much greater than 60. Formula (4)—

$$\mu > 14779 \times \text{sun's mass}$$

gives thus a limit which supposes masses far too small. In reality we might perhaps assume double this without challenging contradiction.

The consideration of a hyperbolic movement takes a similar though less simple form.

If V_0 represents the velocity at an infinitely large distance, we have

$$V^2 - V_0^2 = \frac{2k^2\mu}{r},$$

and according to the Theoria Motus—

$$\frac{r}{a} = \frac{e - \cos F}{\cos F},$$

$$e \tan F - \log \tan (45^\circ + 1/2\,F) = \frac{k\sqrt{\mu}\,.\,t}{a^{3/2}},$$

from which it is found at once that—

$$\left.\begin{aligned} \mu &= \left(1 - \frac{V_0^2}{V^2}\right)^{3/2} \left(\frac{V}{c\sqrt{2}}\right)^3 \frac{cA}{R} X \\ X &= \left(\frac{e - \cos F}{\cos F}\right)^{3/2} \cdot \frac{1}{e \tan F - \log \tan (45^\circ + 1/2\,F)} \end{aligned}\right\} \quad (5)$$

The expression for X, if one allows F to vary from 0°–90°, first decreases, reaches a minimum, and then increases to infinity. The minimum value can easily be determined for then

$$\frac{3}{4}\frac{e \sin 2F}{(e - \cos F)^2}\,[e \tan F - \log \tan (45^\circ + 1/2\,F)] \text{ must be } = 1.$$

This equation can be easily solved for special values of e. For the theoretical calculation which is requisite, I have employed another proceeding, as I have already computed the serial values of X for a special value of e, as the following table shows:—

	$e = 1{\cdot}5$	2·0	4·0	6·0	8·0	10·0
F = 4	10·207	14·393	24·882	32·111	37·988	43·071
8	5·224	7·302	12·554	16·182	19·135	21·689
12	3·614	4·987	8·494	10·930	12·913	14·630
16	2·852	3·866	6·505	8·348	9·853	11·156
20	2·429	3·226	5·345	6·838	8·059	9·118
24	2·178	2·827	4·603	5·866	6·902	7·802
28	2·027	2·569	4·343	5·204	6·112	6·902
32	1·941	2·400	3·753	4·740	5·555	6·265
36	1·900	2·293	3·510	4·411	5·158	5·810
40	1·892	2·234	3·345	4·181	4·877	5·486
44	1·911	2·211	3·240	4·029	4·688	5·266
48	1·953	2·220	3·187	3·941	4·574	5·131
52	2·017	2·257	3·179	3·911	4·528	5·072
56	2·101	2·323	3·217	3·936	4·547	5·086
60	2·208	2·420	3·301	4·020	4·633	5·175
64	2·341	2·552	3·438	4·170	4·797	5·351
68	2·510	2·729	3·644	4·404	5·056	5·635
72	2·728	2·968	3·944	4·754	5·451	6·070
76	3·026	3·307	4·390	5·286	6·055	6·739
80	3·477	3·830	5·108	6·152	7·048	7·843
84	4·308	4·802	6·480	7·824	8·972	9·991
88	6·991	7·938	10·960	13·320	15·321	17·091

For very large values of e the minimum of X occurs if

$$\sin F = \sqrt{2/3},$$

and the minimum value of X becomes

$$\text{Min } X = \sqrt{\frac{3^{3/2} e}{2}} = 1{\cdot}612\sqrt{e} \quad \dots\dots \quad (6)$$

But one practically commits no error if one employs (6) also for the values of e nearly equal to 1, as is evident from the following computation of the minima values taken from the above table, and calculated according to formula (6).

e	Direct.	Formula.
1	1·5	1·6
1·5	1·9	2·0
2	2·2	2·3
4	3·2	3·2
6	3·9	3·9
8	4·5	4·6
10	5·1	5·1

One obtains:—

$$\mu > 0{\cdot}0104\left(1 - \frac{V_0^2}{V^2}\right)^{3/2}\left(\frac{V}{c}\right)^3 \sqrt{e}\,.\,t \quad \dots\dots \quad (7)$$

For the above assumptions—

$$t = {}^{\cdot}0, \left(\frac{V}{c}\right) = 30,$$

we find

$$\mu > 16800\sqrt{e}\left(1 - \frac{V_0^2}{V^2}\right)^{3/2}$$

which formula holds good for values of e, which do not quite equal 1. In order to include also the parabola we suppose

$$\mu > 15000\sqrt{e}\left(\frac{V^2 - V_0^2}{V^2}\right)^{3/2} \quad \dots\dots \quad (7a)$$

Thus in this case we result in extremely large masses, which are not very probable, or we must assume that $\frac{V_0}{V}$ = very nearly 1. Even for $\frac{V_0}{V} = 0{\cdot}9$, according to the above formula, $\mu > 1200\sqrt{e}$, and we may consider the above-given assertion as justified. It has already been remarked that this suggested inequality proves only that μ is very much greater than the right side (of the equation).

It is easy to find a higher limit for μ if $\frac{V_0}{V}$ does not differ much from unity.

If we put $\frac{V^2 - V_0^2}{V^2 + V_0^2} = \nu$, we obtain $\cos F = \nu e$, and according to formula (5):

$$\mu = \left(\frac{1 - \nu}{1 + \nu}\right)^{3/2}\left(\frac{V}{c}\right)^3 \frac{ct}{R} \cdot \frac{\nu}{e\nu \tan F - \nu \log \tan (45^\circ + 1/2\,F)}.$$

Given t, c, and v, we can calculate the right-hand side. But we seek, however, the maximum value of

$y = ev \tan F - v \log \tan (45^\circ + 1/2F) = \sin F - v \log \tan (45^\circ + 1/2F)$

by determining e as function of v. It is

$$\frac{\partial y}{\partial e} = \left(\cos F - \frac{v}{\cos F}\right)\frac{\partial F}{\partial e} = \frac{v(1 - ve^2)}{e\sqrt{1 - v^2e^2}}.$$

Thus y increases so long as $e < \frac{1}{\sqrt{v}}$, and decreases continually for $e > \frac{1}{\sqrt{v}}$. The maximum for y takes place when $e^2 = \frac{1}{v}$, and is

$$y = \sqrt{1 - v} - v \log\left(\frac{1 + \sqrt{1 - v}}{\sqrt{v}}\right).$$

Thus we have

$$\mu > \frac{ct}{K}\left(\frac{V}{c}\right)\left(\frac{1 - v}{1 + v}\right)^{3/2} \cdot \frac{v}{\sqrt{1 - v} - v \log\left(\frac{1 + \sqrt{1 - v}}{\sqrt{v}}\right)}; \quad . \ (8)$$

and with $\frac{V}{c} = 30$ and $t = 60$ days,

$$\mu > 27800\left(\frac{1 - v}{1 + v}\right)^{3/2} \frac{v}{\sqrt{1 - v} - v \log\left(\frac{1 + \sqrt{1 - v}}{\sqrt{v}}\right)}.$$

For the above example $\frac{V_0}{V} = 0·9$ results $\mu > 2800$ as considerably larger masses than formerly.

I have now further to prove that a very close proximity of the two bodies can have only taken place for a very short space of time. To do this we use the following relations.

We find above for the parabola:

$$\mu = \frac{V^3 t}{4k^2 x}; \; x = \sin \tfrac{1}{2}v(1 - 2/3 \sin^2 1/2v).$$

It follows, therefore, that

$$V^2 = \frac{2k^2\mu}{v}$$

$$r = \frac{Vt}{2x}.$$

Thus we have

$$v > \frac{3}{2\sqrt{2}}. \; Vt = 1.06Vt \quad . \; . \; . \; . \; . \; . \; (9)$$

For the hyperbola we have

$$r = \frac{2k^2\mu}{V^2 - V_0^2},$$

and, according to formula (5)

$$2k^2\mu = \frac{(V^2 - V_0^2)^{3/2}}{\sqrt{2}} tX.$$

Therefore,

$$r = \frac{\sqrt{V^2 - V_0^2}}{\sqrt{2}} tX.$$

For eccentricities which are not very nearly equal to 1, we had

$$X > \frac{3^{3/4}}{\sqrt{2}}. \; \sqrt{e},$$

and it is certainly

$$r > \frac{3^{3/4}}{2}\sqrt{e}\sqrt{V^2 - V_0^2}. \; t > 1·05\sqrt{V^2 - V_0^2}\,t \quad . \ (10)$$

For $V_0 = 0$.

(10) is naturally changed into (9). For the hyperbola, however, it is possible to suggest a second relationship.

Since

$$2\frac{a}{r} = \frac{V^2 - V_0^2}{V_0^2}.$$

(5) can also be written

$$k^2\mu = \left(\frac{a}{r}\right)^{3/2} V_0^3 tX.$$

and because $k^2\mu = aV_0^2$, it follows that

$$r = \sqrt{\frac{a}{r}}. \; V_0 tX = V\,ty,$$

where

$$y = \frac{e - \cos F}{\cos F} \cdot \frac{1}{e \tan F - \log \tan (45^\circ + 1/2F)}.$$

An easy calculation yields now

$$\frac{\partial y}{\partial F} = \frac{-1}{e \sin F - \cos F \log \tan (45^\circ + 1/2F)} \cdot [(1 + e^2)\cos F - 2e + e \sin F \log \tan(45^\circ + 1/2F)].$$

It is quite evident that the quantities in brackets always remain positive, for it is

$\log \tan (45^\circ + 1/2F) = 2 \tan \tfrac{1}{2} F + \tfrac{2}{3} \tan^3 1/2F + \ldots > 2 \tan 1/2F$,

and in consequence of it the quantity in brackets $> (e - 1)^2 \cos F$. Thus, $\frac{\partial y}{\partial F}$ is negative, and y decreases as F increases. From this it follows that $y > 1$, and the relation $r > V_0 t$, is the result.

If we apply this formula to Nova Aurigæ, we obtain for

$\frac{V_0}{V} =$	$\sqrt{V^2 - V_0^2} =$	$V_0 =$
0·5	108 miles,	60
0·6	96	72
0·7	86	84
0·8	72	96
0·9	—	108

In the vicinity of perihelion the velocity has been under every condition greater than 120 miles, and we shall therefore obtain values of r that are considerably too small, by supposing $r > t \times 85$ miles. One day before or after perihelion it is therefore certain that $r > 7·3$ million miles.

It will therefore hardly be possible to assume that any noticeable influence of the supposed two bodies can have lasted longer than a few hours.

Since the above article was written Nova Aurigæ has by its reappearance attracted considerable attention, and especially by the observation as made by Prof. Barnard. With regard to this reappearance one must necessarily see an evident confirmation of the critical part of my article. Nor has my hypothesis been contradicted in any way, for it is evident in itself that the supposed formations of the nebulous or dusty matter are more copious in certain parts of space, and one may have different ideas of the distribution of density of these formations.

To the observation made by Prof. Barnard (*Astr. Nach.*, 3114) I wish to add the following remarks. I had formed an idea of the whole process which caused the outburst of the Nova, which idea is as perfectly represented in Prof. Barnard's drawing, kindly communicated to me by Prof. Kreutz, as I could expect. During the appearance of the Nova in the winter nothing similar was seen so far as I know. It does not follow from this, therefore, that it did not exist, and it would also have been possible to have expected information from the photographs as has often occurred before. I applied on this account to Dr. Wolf, in Heidelberg, and asked him whether he had photographs of the region of the Nova at that time, and whether, perhaps, any nebulous object was to be seen on them; but, unfortunately, Dr. Wolf did not possess such photographs. It remains doubtful, I am sorry to say, whether so delicate an object would have been visible on the plates.

W. J. LOCKYER.

HINTS FOR COLLECTORS OF MOLLUSKS.[1]

AFTER the collector has brought home the spoils of his excursion there is still a good deal to be done before the wet and dirty shells, covered with parasitic growths or inhabited either by the original mollusk or some hermit crab, will be ready to be placed in the cabinet. Some of them, if living, may find a temporary place in an aquarium for the study of their habits, but, for the most part, the collector will wish to prepare his specimens either for anatomical use in the future or as dry specimens for his cabinet. The preparation of mollusks for anatomical purposes has been described in a special chapter of these instructions. For ordinary rough work nothing is better than clean 90 per cent. alcohol diluted with a proper proportion of water. If the specimens are large they should be first put into a jar kept for that special purpose, in which the alcohol is comparatively weak, having, say, 50 per cent. of water added to it. After the immersion of specimens in this jar for several days the fluids will have been extracted by the alcohol, and a specimen can then be removed, washed clean of mucus and dirt, which will almost always be found about the aperture of a spiral shell, and

[1] Reprinted from "Instructions for Collecting Mollusks, and other Useful Hints for the Conchologist," by William H. Dall; issued by the Smithsonian Institution as Part G of *Bulletin* of the U. S. National Museum, No. 39.

placed in its own proper jar of 90 per cent. alcohol diluted in the proportion of 30 per cent. with pure water. Specimens to be prepared for the cabinet require the removal of the soft parts if they are still present, the cleaning off of parasitic or incrusting growths, and, in the case of bivalves, securing the valves in a convenient position for the cabinet. The different classes of shells may be treated under several heads.

Land and Fresh-Water Shells.

Land and fresh-water shells are much more easy to deal with than marine shells. In the case of spiral shells, such as *Limnæa*, *Planorbis*, *Paludina*, &c., the shell may first be washed clean of mud or comfervoid growth, which may be conveniently done with the assistance of an old tooth or nail brush. In the case of these forms the easiest way to remove the soft parts is to place the shell for twenty-four hours in weak alcohol, after which those parts can readily be removed; but in any case where the expense of alcohol is an object to be avoided, it will be sufficient to place them in a small tin kettle, or other receptacle suitable for the purpose, and cover them with cold water, which should then be slowly brought to the boiling point. As soon as it has reached the boiling point it may be removed from the fire. The shells should not be put into water already boiling, as it frequently cracks delicate shells, and the sudden change of temperature injures their polish and general appearance.

For removing the soft parts from spiral shells the collector will usually find a crooked pin sufficient. For this purpose one of those long steel pins used by ladies as hat pins is convenient. By heating the pointed end in the flame of a candle or alcohol lamp the temper can be taken out of the steel, so that it can be readily bent into any shape desired. The proper form for reaching the retracted parts in a spiral shell will of course be a spiral. With a small pair of plyers, different forms can be experimented with, and those which are most satisfactory decided upon. After the right form has been obtained, by heating the pin again and plunging it suddenly into cold water, the temper of the steel will be measurably restored and the instrument ready for use. Similar pins in their ordinary condition are convenient for cleaning out sand or parasites from the recesses of sculptured shells, and for other purposes. The attachment of a gastropod to its shell is at the central axis or pillar of the shell, usually from half a turn to a turn and a quarter behind the aperture. By applying the pressure of the extractor carefully in this vicinity the attachment will give way and the extractor may be withdrawn, bringing with it the soft portions of the animal. In large and heavy shells, in which the muscular attachments are strong and deep-seated, and it is desired to obtain a good hold of the animal in order to extract it from the shell ordinary steel fish-hooks may be used. These may be softened by heat, straightened out, and twisted into a spiral of the proper form, and retempered. Then they can be securely fastened to small wooden handles by the shank of the hook. In this way the barb of the hook will assist in retaining the soft parts on the extractor when it is withdrawn from the shell. Several German firms advertise sets of implements for cleaning, cooking, and extracting the animals from shells of mollusks, but it would seem to the writer that any person of ordinary intelligence and some little mechanical ingenuity, such as all naturalists are expected to possess, should be able to provide himself with the necessary apparatus without purchasing expensive paraphernalia of this kind. Shells which have no operculum require merely to be cleaned after the animal has been removed, and in the case of land and fresh-water shells this is usually a very simple matter. Shells which possess an operculum should retain it in the cabinet, as it is often of great value in determining the relations of the species, since the operculum is a characteristic feature in the economy of the animal. It should be detached from the body of the animal after the latter has been extracted from the shell, carefully washed and cleaned, and if flat and horny may be dried between two pieces of blotting paper, under a weight. This will prevent it from becoming contorted in the process of drying. For removing the thick incrustation of lime and peroxide of iron which frequently forms upon fresh-water shells, a few tools resembling engraver's tools or the little chisels in use by dentists for excavating teeth are very convenient. A suitable tool, however, can easily be made by softening and grinding down an old file to a triangular point. A little experience will enable the collector to become expert in scaling off the objectionable matter without injury to the surface of the shell.

Naked slugs should be preserved in alcohol, after being sketched in the living state. Some of the older naturalists had a way of skinning slugs, inflating and drying the empty skins for preservation in their collections, much as entomologists sometimes treat caterpillars; but this ingenious device has nothing to recommend it to a scientific collector, even if he has the dexterity to practise it. The internal shell of such slugs as *Limax* may be represented in the collection if desired, but, in any case, specimens should be carefully preserved in spirits.

The bivalve shells, such as *Unio*, if taken alive, may be left in the sun for a short time, when they will usually open, and, the muscle connecting the two valves being cut, the valves may be cleaned. It is desirable for cabinet purposes to preserve the two valves in their natural position, attached to each other by the ligament which holds them together in life. This ligament dries to a very brittle, horny substance. Consequently the shells must be placed in position when fresh in order to make a success of the operation. After cleaning away the animal matter and thoroughly washing the interior of the shell, it is a good plan to note the locality with a soft lead-pencil upon the shell itself. Then bring the two valves together in their natural position and tie them in that position with a piece of tape or soft twine, which should be allowed to remain until the ligament is thoroughly dry. Specimens prepared in this way are more valuable for exchange and more attractive to the eye than those with which less care has been taken. It is always desirable, however, to have some specimens with separated valves of every bivalve species in the cabinet, in order that the characteristics of the interior may be easily examined.

Fresh-water bivalves are usually covered with a thin and highly polished, often very elegant, greenish or brownish epidermis. Sometimes the shell is so thin that, in drying, the contracting epidermis splits and cracks the shelly portion so that it becomes worthless for the cabinet. This often happens with marine mussels, but it is almost characteristic of the thin fresh-water *Unionidæ*. Various methods have been adopted to prevent this unfortunate result. Some collectors have varnished their shells immediately after they were obtained. Others have used sweet oil or other oils in the hope of keeping the epidermis in a soft condition. These applications are all objectionable for one reason or another, as the first endeavour of the collector who desires to make a really scientific collection should be to keep his specimens as nearly as possible in a perfectly natural condition. The most satisfactory substance for application to the shells in question is probably ordinary vaseline, which should be applied in very small quantities, so that the specimen will have no greasy feeling and will absorb the vaseline sufficiently not to become sticky to the touch. Glycerine, which has been recommended by several collectors, like oil, leaves the surface sticky and offensive to the touch, besides rendering it liable to catch everything in the way of dust with which it may come in contact.

Very small gastropod shells need not have the soft parts removed. If they are put into a vial of alcohol for twenty-four hours, then taken out and allowed to dry, the soft parts will become desiccated without any offensive odour, and they may be placed in the cabinet without further preparation. It may be noted, however, that if the cabinet contains many such shells, care should be taken to guard against the access of mice and vermin, which are apt to attack them in the absence of something more attractive in the way of food. For those shells which possess an operculum, after the operculum has been dried and the shell cleaned and ready for the cabinet, it is customary to insert a little wad of raw cotton, rolled so as to fit the aperture snugly, the outer surface of it being touched with a drop of mucilage. The operculum can then be laid upon this in its natural position and the mucilage and cotton will retain it so without making it difficult to remove for an examination of the shell if desired at any time. For the preservation of eggs of mollusks when they have a horny or calcareous shell, small glass tubes securely corked are the best receptacles. Most of these eggs are so small that they may be preserved in a dry state or in alcohol without trouble, but the eggs of some of the tropical land snails are so large that it will be necessary to drill a small hole and extract the fluid contents as if they were bird's eggs in order to preserve them. Such eggs are the best preserved in alcohol.

Marine Shells.

The preparation of marine shells for the cabinet does not essentially differ from that required for land or fresh-water shells, except that in the marine shells the muscular system is

often much more strongly developed and the creatures themselves much larger than the fresh-water forms, and the manipulation is therefore somewhat more difficult. The marine forms are also more apt to be incrusted with foreign bodies, bored by predatory sponges, like *Cliona*, or even by other mollusks, or perforated by certain annelids which have the power to dissolve the lime of which the shell is composed, and in this way secure a retreat for themselves.

Shells which do not contain the living animal are frequently occupied by hermit crabs or by tubicolous annelids. The latter fill up the larger part of the spire with consolidated sand or mud, in the centre of which they have their burrow. The hermit crabs do not add anything to the shells which they occupy, but, on the contrary, by their constant motion are apt to wear away the axis or pillar of the shell, so that often a specimen of this sort may be very fairly preserved and yet on the pillar show characters entirely different from those which one would discover in a specimen which had never been occupied by a crab. A shell which the crab has selected for its home is often taken possession of, as far as the outside is concerned, by a hydractinia, a sort of polype, which produces a horny or chitinous covering which is very difficult to remove from the shell to which it is attached. As the hydractinia grows it finally covers the whole shell, to some extent assumes its form, and then, if the creature has not attained its full growth, this is apt to take place around the edges of the aperture, which are continued by a sort of leathery prolongation which assumes in a rough way the form of a shell. The crab, when he grows too large for the shell in which he has ensconced himself, is usually obliged to abandon it and find a larger one, which is always a difficult and more or less dangerous operation; but if his shell is overgrown by the polype referred to, it often happens that the polype and the crab grow at about an equal rate, so that the latter finds himself protected and does not have to make a change. It is supposed that the polype profits to some extent by the microscopic animals attracted by the food or excrement of the crab, so that this joint housekeeping is mutually beneficial, and, for such cases, since the word *parasite* would not be strictly accurate, the word *commensal* has been adopted. These modified shells often assume very singular shapes. The polype is able in the course of time to entirely dissolve the original calcareous shell upon which its growth began, so that if the spire be cut through it would be found throughout of a horny or chitinous nature. Some of the older naturalists were deceived by forms of this sort and applied names to them, supposing that they were really molluscan shells of a very peculiar sort.

In removing the animal matter from the shell of large gastropods it will often require a good deal of time and care to get out all the animal matter from the spire, but it is well worth while to take the trouble, as the presence of such matter forms a constant attraction for museum pests of all descriptions. A medium-sized syringe is convenient for washing out the spire of such shells. The ordinary marine gastropods may be treated in a general way like the fresh-water gastropods. There are, however, abnormal forms, especially among tropical species, which require particular attention. Some species become affixed to corals and overgrown by them, retaining only a small aperture through which the sea water can reach the prisoner. Such specimens are best exhibited by retaining a part of the coral and cutting the rest away, showing at once the mode of occurrence and the form of the covered shell. Borers are always more difficult to handle and prepare for the cabinet than other mollusks. They are usually more or less modified for their peculiar mode of life, and frequently rely upon their burrow as a protection, so that the shell is reduced, relatively to the animal, to a very small size. Most of these forms are best kept in alcohol. The hard parts may properly be represented in the cabinet by other specimens. Some of the bivalves, such as the American "soft clam," possess very long siphons, covered with a horny epidermis, and it becomes a question as to whether an attempt should be made to preserve this epidermis in the cabinet or not. The writer has seen very nicely prepared specimens in which the fleshy portions had all been taken out and replaced by cotton, so that the epidermis of the siphon retained its original position and form; but such specimens are always very delicate, easily broken, and liable to attack by insects, so that it would seem hardly worth while to go to the trouble, when specimens may be preserved complete in alcohol showing all the features referred to. Boring shell-fish, like *Pholas*, frequently have accessory pieces, which are liable to be lost when the soft parts are removed unless care is taken to avoid it. Other bivalves have the internal ligament reinforced by a shelly plate, which is called the ossiculum. This is very easily detached and lost, and, being an object of great interest, special pains should be taken to preserve it, even if it should become detached.

JAPANESE CAMPHOR.

THE United States Consul at Osaka gives in a recent report the following particulars, reprinted from the November number of the *Board of Trade Journal*, respecting the Japanese camphor trade:—

The camphor tree, from which the resinous gum is distilled, is a species of the laurel, and is found in the provinces of Tosa, Hiuga, and Satsuma, in the south of Japan. Large groves of the trees are owned by the Japanese Government, the wood being very desirable for shipbuilding. The districts in which the camphor tree is found are mountainous and situated far from the sea. No reliable information can be obtained as to the cost of producing the gum before being transported in junks to Hiogo. The peasants who engage in distilling the roots and branches of the trees are said to be poor, and employ the rudest machinery.

The market value of crude camphor gum and of oil of camphor per picul ($133\frac{1}{3}$ lbs.) during the past year was as follows:—Drained, 38·25 dols.: wet, 37·00 dols.; old dry, 43·50 dols.; average, 36·50 dols.; camphor oil, 5·25 dols.

The highest and lowest prices during the same period were as follows:—Highest, 40·00 dols.; lowest, 33·00 dols.

Camphor gum is exported in tubs measuring about $6\frac{1}{2}$ cubic feet; oil in kerosene tins and cases. The grades are from old dry down to new wet, and the various grades depend upon the quantity of adulteration. In oil there are two grades—white and brown.

Adulteration is practised for the most part by adding water and oil just as far as the buyer will tolerate. In some cases 20 lbs. of water will run out of a tub in twelve hours. The unadulterated article, known as the good old dry, can sometimes be bought. The only system of tests in determining value of the different qualities is by burning and by absolute spirit. The percentage of pure camphor which the crude yields when refined varies according to the quality of the crude. The average percentage of gum produced from the wood as compared with the original weight of the wood cannot be accurately ascertained here, the only foreigner known to have visited the camphor districts having declined to furnish any information on the subject.

The total exports of camphor from Hiogo during 1891 in catties of $1\frac{1}{3}$ lbs. each amounted to 3,850,400 catties consigned to the following destinations: Europe (countries not specified), 1,777,300 catties; London, 335,600 catties; Germany, 209,200 catties; United States, 1,277,000 catties; China, 51,900 catties; France, 199,400 catties.

As regards the manufacture of camphor the following particulars are extracted from a report by the United States Consul at Nagasaki.

Camphor is found alike on high elevations and in the valleys and lowlands. It is a hardy, vigorous, long-lived tree, and flourishes in all situations.

Many of these trees attain an enormous size. There are a number in the vicinity of Nagasaki which measure 10 and 12 ft. in diameter. The ancient temple of Osuwa, at Nagasaki, is situated in a magnificent grove of many hundred grand old camphor trees, which are of great age and size, and are still beautiful and vigorous. It is stated that there are trees at other places in Kiu Shiu measuring as much as 20 ft. in diameter. The body or trunk of the tree usually runs up 20 and 30 ft. without limbs, then branching out in all directions, forming a well-proportioned, beautiful tree, ever green and very ornamental.

The leaf is small, elliptical in shape, slightly serrated, and of a vivid dark-green colour all the year round, except for a week or two in the early spring, when the young leaves are of a delicate, tender green. The seeds or berries grow in clusters and resemble black currants in size and appearance. The wood is used for many purposes, its fine grain rendering it especially valuable for cabinet-work, while it is used also for shipbuilding. The roots make excellent knees for ships.

In the manufacture of camphor the tree is necessarily destroyed, but, by a stringent law of the land, another is planted

in its stead. The simple method of manufacture employed by the natives is as follows:—

The tree is felled to the earth and cut into small pieces, or, more properly speaking, into chips.

A large metal pot is partially filled with water and placed over a slow fire. A wooden tub is fitted to the top of the pot, and the chips of camphor wood are placed in this. The bottom of the tub is perforated so as to permit the steam to pass up among the chips.

A steam-tight cover is fitted on the tub. From this tub a bamboo pipe leads to another tub, through which the enclosed steam, the generated camphor and oil flow. This second tub is connected in like manner with a third. The third tub is divided into two compartments, one above the other, the dividing floor being perforated with small holes, to allow the water and oil to pass to the lower compartment. The upper compartment is supplied with a layer of straw, which catches and holds the camphor in crystal in deposit as it passes to the cooling process. The camphor is then separated from the straw, packed in wooden tubs of 133⅓ lbs. each, and is ready for market.

After each boiling the water runs off through a faucet, leaving the oil, which is used by the natives for illuminating and other purposes.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. W. Ridgeway, late Professor at Queen's College, Cork, has been elected to the Disney Professorship of Archæology for the customary period of five years. Prof. Ridgeway's recent work on the origins of weights and measures have made him well known as a scientific archæologist.

Mr. R. T. Glazebrook, F.R.S., Assistant Director of the Cavendish Laboratory, has been appointed a member of the Financial Board; Mr. Lewis, Professor of Mineralogy, and Dr. Gaskell, F.R.S., have been elected members of the General Board of Studies; and Mr. E. W. MacBride, Scholar of St. John's College, has been appointed Demonstrator in Animal Morphology, in the place of Mr. J. J. Lister, of the same College.

The Museums and Lecture Rooms Syndicate propose to introduce the electric light into the dissecting-room of the Anatomy school, the lecture room, and histology class-room of the Department of Physiology, and the Philosophical Library, at an expense not exceeding £100.

By the death, on November 30, of Dr. F. J. A. Hort, Lady Margaret Professor of Divinity, the University has lost not only a great theologian, but a distinguished student of science. Dr. Hort was second to Prof. Liveing in the Natural Sciences Tripos of 1851, the first ever held. He received the mark of distinction in Physiology and in Botany. In 1856, and again in 1871, he was an examiner for Honours in this Tripos. Throughout his life his interest in the scientific progress of the University was deep and hearty.

A Syndicate has been appointed to consider the whole question of the times of holding Tripos examinations, and the changes that would follow if these were altered. The disadvantages of the present system, by which much of the benefit of the Easter term and of the Long Vacation are lost to students and teachers alike, have of late been forcibly brought before the Senate. It is to be hoped that, by bringing about a rational "Easter" or otherwise, the Syndicate's efforts may lead to a reformation.

SCIENTIFIC SERIALS.

American Meteorological Journal, November, 1892.—Wind measurement by H. W. Dines. The two instruments generally in use, viz. the Robinson cup anemometer and the pressure plate, are both more or less unsatisfactory in obtaining the extreme pressure. The wind never blows uniformly, whereas the instruments are calibrated on the supposition that it does so. And the method of exposure is often unsatisfactory; any obstacle to the free circulation of the wind either at the side or even behind or below the anemometer, vitiates the results. The usual factor k for conversion of velocity to pressure in the equation $P = kv^2$ is too high. The value ·005 was given originally in a book on engineering, with a footnote stating that the experiments on which it rested were doubtful, but it has since been copied without the note. Recent experiments show that ·003 is probably more correct, but with such a varying element as the wind, any factor is of little use in deducing extreme pressures from velocity anemometers. Instruments of different sizes give different results, and those calibrated by indoor trials give more wind than those tested out of doors. In some respects it is more desirable to register the pressure than the velocity, but a pressure plate which is to register 30lb. per square foot is hardly suitable to record so small a force as one ounce, so that on many days no sign of motion is given. The author concludes from many careful experiments that the tube form of anemometer is most likely to give satisfactory results, as, apart from electricity, it is the only kind in which the motion or pressure can be transmitted to a distance without loss by friction. In this instrument the registering apparatus is placed away from the part exposed to the wind.—The storms of India, by S. M. Ballou. In this article, which is a continuation of previous papers, the author treats of the storms which accompany the winter and summer rains.—The first aerial voyage across the English Channel, by R. de C. Ward. This voyage was successfully carried out by Dr. Jeffries and M. Blanchard on January 7, 1785. The balloon left Dover at 1h. p.m., and descended a few minutes before 4h. p.m., not far from Ardres.—On the production of rain, by Prof. C. Abbe. The author reviews the natural process of the formation of rain, viz. saturation by aqueous vapour, condensation into visible particles, and the agglomeration of these into drops large enough to be precipitated. The problem of artificial formation of rain will be partially solved if some method is invented to bring about a sudden formation of large drops out of the moist air that exists between the small particles of every cloud.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, November 28.—M. d'Abbadie in the chair.—Note accompanying the presentation of a work on the new methods of the "Mécanique Céleste," by M. Poincaré.—On the existence of distinct nervous centres for the perception of the fundamental colours of the spectrum, by M. A. Chauveau. If one goes to sleep on a seat placed obliquely in front of a window which allows the light from white clouds to fall equally on both eyes, the coloured objects in the room appear illuminated by a bright green light during a very short interval when the eyelids are opened at the moment of awakening. The phenomenon is not observed except at the moment of awakening from a profound sleep. From this it is concluded that there are distinct perceptive centres for the green, and probably also for the violet and the red. Of these, the green centres are those which first regain their activity on awakening.—Note on the observatory of Mont Blanc, by M. J. Janssen.—On the laws of expansion of liquids, their comparison with the laws relating to gases, and the form of the isothermals of liquids and gases, by E. H. Amagat. The substances examined were water, ether, alcohol, carbon bisulphide, hydrogen, nitrogen, air, oxygen, ethylene, and carbonic acid, the pressures ranging from 50 to 3000 atmospheres, and the temperatures from 0° to 200°. For both liquids and gases, the isothermals present a slight curvature turned towards the axis of abscissæ. The angular coefficient increases with the temperature. This effect is specially pronounced in the liquids, where it corresponds to a widening-out of the network, well exemplified in carbonic acid, in the part corresponding to the lower temperatures. This widening-out gradually disappears as the temperature rises; in the lighter gases, the variation with the temperature is very small.—Observations of Holmes's comet ("*f*" 1892), made at the Paris Observatory (west equatorial), by M. O. Callandreau.—On a remarkable solar protuberance observed at Rome on November 16, 1892, by M. P. Tacchini.—On universal invariants, by M. Rabut.—On straight-line congruences, by M. E. Cosserat.—On the passage of a wave through a focus, by M. P. Joubin. An apparatus for showing the complementary character of transmitted and reflected Newton's rings is mounted vertically, and illuminated by a small bright point placed at a distance of 1·20m. along the axis of symmetry. On moving a microscope along the axis of reflection the rings first appear with a black centre, which changes into white at the first focus of reflection, and again into black at the second.—On the depression of the zero, observed in boiled thermometers, by M. L. C. Baudin. The secular

depression of the zero, brought into prominence by heating to 100°, may be greatly reduced by keeping the thermometers for several days immersed in a liquid boiling at 400° or 500°.—On the fusion of carbonate of lime, by M. A. Joannis.—Action of antimony on hydrochloric acid, by MM. A. Ditte and R. Metzner.—On the zincates of the alkaline earths, by M. G. Bertrand.—On anhydrous and crystallized fluorides of iron, by M. C. Poulenc.—Preparation of metallic chromium by electrolysis, by M. Em. Placet. An aqueous solution of chrome alum, to which is added an alkaline sulphate and a small quantity of sulphuric or other acid, is electrolyzed. Pure chromium is deposited at the negative pole. It is very hard, and of a fine bluish-white colour. It resists atmospheric influences, and is not attacked by concentrated sulphuric acid, by nitric acid, or by concentrated potash solution. Articles made of brass, copper, or iron may be coated with chromium, thus giving them a metallic lustre resembling oxidized silver. Large quantities of the metal can be prepared without difficulty.—On the preparation of hydrobromic acid, by M. E. Léger.—Reply to M. Friedel's observations on the rotatory power of the diamine salts, by M. Alb. Colson.—Point of fusion of solvents as the inferior limit of solubilities, by M. A. Etard.—Action of the chlorides of dibasic acids on cyanacetic sodium ether; succinodicyanacetic ether, by M. Th. Muller.—On the functions of hydurilic acid; preparation of potassium hydurilates, by M. C. Matignon.—Researches on the colours of some insects, by M. A. B. Griffiths.—Microbicidal action of carbonic acid in milk, by M. Cl. Nourry and C. Michel.—On a nervous ganglion of the feet of *Phalangium opilio*, by M. Gaubert.—Myxosporidia of the bile duct of the Fishes; new species, by M. P. Thélohan.—On the modifications of absorption and transpiration which occur in plants under the influence of frost, by M. A. Prunet. The rapid dessication of the young shoots of frozen plants is due to the substitution of an intense evaporation for the normal function of transpiration, and to an almost complete suspension of absorptive functions.—*Æcidiconium*, a new genus of Uredinei, by M. Paul Vuillemin.—On the classification and the parallelisms of the miocene system, by M. Ch. Depéret.—On the existence of micro-granulite and orthophyre in the primary formations of the French Alps, by M. P. Termier.—On the mineralogical modifications of the calcareous strata in the inferior Jurassic of Ariège due to lherzolite, and their bearing on the history of this eruptive rock, by M. A. Lacroix.—On the geographical distribution, the origin, and the age of the ophites and lherzolites of Ariège, by M. de Lacvivier.—Geological observations on the *Creux de Souci* (Puy-de-Dôme), by M. Paul Gautier.

BERLIN.

Physiological Society, October 28.—Prof. du Bois Reymond, President, in the chair.—Prof. Gad spoke on the respiratory centre on the basis of experiments made in his laboratory by Herr Marenescu. According to these, the centre for the co-ordination of the respiratory muscles lies in the *formatio reticularis grisea* and *alba* below the hypoglossal centre, on each side of the hypoglossal tract, whereas in the apex of the *calamus scriptorius* there is an inhibitory centre (nœud vital) whose stimulation may cause death. It further appeared from these experiments that the respiratory centre is not confined to a limited area, but is diffuse and quite distinct from Flouren's "nœud vital."

November 11.—Prof. du Bois Reymond, President, in the chair.—Dr. Ad. Loewy had investigated the influence on respiration of the upper tracts leading from the cerebrum to the respiratory centre, an influence which is specially marked after section of the vagi. He found that these tracts do not simply hand on to the centre impulses received from the periphery up the trigeminal nerve, but that they automatically maintain the rhythm of the centre after the vagi have ceased to function. Dr. René du Bois Reymond spoke on the sensation of warmth which ensues on immersing the hand in a vessel of carbon dioxide. Sulphurous acid, bromine vapour, nitrogen peroxide, ammonia and hydrochloric acid gas produce the same effect. The intensity of the sensation varies with the different gases. Thus carbon dioxide produces the same sensation as air warmed to 20°, while that of nitrogen peroxide is as of air at 30° and that of ammonia and hydrochloric acid gas as of air above 40°. The phenomena do not as yet admit of a physical explanation, but must be regarded rather as resulting from a chemical stimulation of the sensory nerves for heat perception. The President exhibited a torpedo recently born in Berlin, in which he had detected an active electric organ immediately after birth, by means of a nerve-muscle preparation and a galvanometer. This observation was first made in 1831 by Davy, but had not since then been repeated.

BOOKS, PAMPHLETS, and SERIAL RECEIVED.

BOOKS.—The Scenery of the Heavens: G. E. Gore. 2nd edition (Sutton).—Johnston's Catechism of Agricultural Chemistry, from the Edition by Sir C. A. Cameron, revised and enlarged by C. M. Aikman (Blackwood).—Coal Pits and Pitmen: R. N. Boyd (Whittaker).—Practical Electric-Light Fitting: T. C. Allsop (Whittaker).—Sound and Music: Rev. J. A. Zahm (Chicago, McClurg).—Results of Meteorological Observations made in New South Wales, 1880, 1881, 1882, 1883, and 1884 (Sydney, Potter).—Mineral Resources of the United States, 1889–90: D. T. Day (Washington).—Proceedings of the American Association held at Washington (D.C.).—Meteorological Observations and Results at the U.S. Naval Observatory, 1888 (Washington D.C.).—Magnetic Observations at the U.S. Naval Observatory, 1891 (D.C.).—The Building of the British Isles: A. J. Jukes-Browne. 2nd edition (Bell).—Poems in Petroleum: J. C. Grant (E. W. Allen).—Electric Lighting and Power Distribution. Part 1: W. P. Maycock (Whittaker).—Old and New Astronomy: R. A. Proctor, completed by A. C. Ranyard (Longmans).—Painters' Colours, Oils, and Varnishes: G. H. Hurst (Griffin).—Elementary Mechanics of Solids and Fluids: A. L. Selby (Oxford, Clarendon Press).—The Chemistry of Life and Health: C. W. Kimmins (Methuen).—The Mechanics of Architecture: E. W. Tarn (Lockwood).—Electrical Papers. 2 vols.: O. Heaviside (Macmillan).

PAMPHLETS.—Notes de Géographie Litterale: J. Girard (Paris).—Physical Geography and Climate of New South Wales: H. C. Russell. 2nd edition (Sydney, Potter).—La Grandissima Macchia Solare del Febbraio, 1892: A. Ricco (Rome).—Fumo di Vulcano: A. Ricco (Rome).—Sopra il Periodo Eruttivo dello Stromboli: A. Ricco. G. Mercalli (Rome).—Ueber Heterogene Induktion versucheines Beitrags zur Kenntnis der Reizerscheinungen der Pflanzen: Dr. F. Noll (Leipzig, Engelmann).—Observations on Dew and Frost: Hon. R. Russell (Stanford).—The Cry of the Children: A Free Lance (Williams and Norgate).

SERIAL.—Insect Life, vol. 5, No. 2 (Washington).

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